Journal of Soil & Water Conservation

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SOIL CONSERVATION
SOCIETY OF AMERICA

Hotel George Washington

Jacksonville, Florida

November 15-16-17, 1954

Soil Conservation Society of America

NEWS Notes and Activities

To Advance the Science and Art of Good Land Use

President's Column

I've just received my copy of the July issue of the *Journal of Soil and Water Conservation*. As usual, I am proud of the *Journal* this month. It is a good issue and contains a great deal of information that all workers in the field of soil and water conservation should have.

That reminds me of an experience I had while attending the state-wide meeting of SCS personnel at Clemson, S. C., in June. Ernest Carnes used the latest issue of the *Journal* very effectively in showing those present what it contained and in emphasizing the advantages of Society membership. Maybe Ernest's effective use of the *Journal* had something to do with the fact that we got about 40 new members in South Carolina during the state-wide conference.

In soliciting members during the remainder of this year, you will be able to offer them a bargain. New members paying dues during the rest of this year will be paid up through 1955 and will receive the *Journal of Soil and Water Conservation* free for the remainder of this year.

Here in Alabama, they are having a state-wide meeting of SCS personnel early in September and plans are being made to reactivate the Alabama chapter during a night meeting that will be held with society affairs as a major purpose. I hope we are going to have a substantial increase in membership in the state, and a working chapter, when the meeting is over.

Membership and local chapter activities are so important and are mentioned so often that some of you may get the idea that these are the only interests of the Society. I believe you will be interested in knowing that as one of our broader activities the Council decided in May to accept an invitation to participate in a proposed Policy Committee composed of representatives of professional agricultural societies.

One of the most important purposes of the Policy Committee will be to provide member societies with representation on the Scientific Manpower Commission. The Scientific Manpower Commission will be in a position to advise and make recommendations for the best use of scientific manpower in times of national emergency.

I want to take this opportunity to tell you that your Council has done a mighty fine job this year. The Council is made up of very busy men, but they've responded to every request and have given careful, thoughtful attention to the many problems that confront this growing young society. I hope you will join me in giving them a big hand and in saying, "THANKS FOR EVERYTHING!"

I can't resist the temptation to remind you again of the extreme importance of the proposed changes in our Constitution and By-Laws that you will be asked to consider and vote on very soon after you get your September issue of the *Journal*. These proposals would do two mighty important things: 1) simplify membership classification and give us a more truly democratic society, without lowering our professional standards, and 2) give us a sounder financial status. I hope you are going to give this ballot more than usual care. For several years, I've been studying the issues that you will vote on and I am going to vote for all amendments.

Plans for an outstanding annual meeting are developing satisfactorily. Jack Chambers and other members of the Annual Meeting Program Committee have almost completed the program and it is going to be one of the best. Howard Bissland and his committee on Local Arrangements are planning features that will add much to our enjoyment of the meeting. Jacksonville has shown every indication of being a good host city.

This is your opportunity to attend one of the top professional meetings of your life. Bring your wife and let her enjoy the meeting and the many added features that are being planned for the ladies. Remember the date, November 15-17.

I am very pleased to see the name of Dr. Cecil H. Wadleigh, who heads the Soil-Plant Relationship Section of the Soil and Water Conservation Research Branch of the Agricultural Research Service, on the list of new members. We welcome Dr. Wadleigh as a member and hope he will be joined by others from this important Branch of the Research Service. One of our outstanding needs is for a wider distribution of membership among conservation agencies and other groups.

R. Y. BAILEY,
President

SOCIETY EXHIBIT AT NATIONAL FIELD DAY

The Society will have a booth at the National Soil Conservation District Field Day and Plow Matches at Olney, Illinois, September 16, 17, 18th. The exhibit is in cooperation with the Business and Organization Relations Committee, the Little Egyptian and Southern Illinois Chapters of the Society.

The Caterpillar Tractor Company of Peoria, Illinois, sponsored copies of the booklet "Down the River" for use in the Society exhibit.

IOWA LEADS IN MEMBERSHIP

For many months West Virginia pushed Texas for total membership in the Society. Soon after they forged ahead the Iowa chapter moved to the number one position and the "Mountaineers" remain in second place.

Recent gains in membership have been made in Iowa, West Virginia, Washington, Alabama, North Carolina, South Carolina, Kansas, North Dakota, Florida, Nebraska, Kentucky, Wisconsin, Michigan and Pennsylvania. Several other states have made smaller gains.

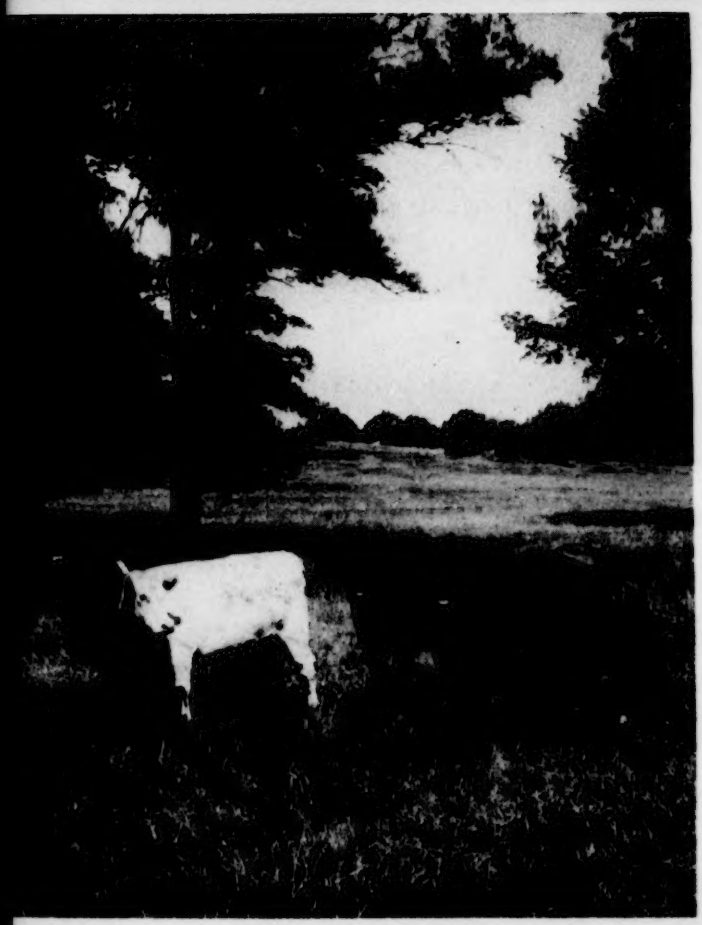
On or about July 1, 1954, individuals who had not paid their dues for the year were dropped from the roles. At the present time approximately 750 remain delinquent, 47 cancellations have been received and 18 members are deceased. While the number of names dropped from the roles is higher than for the past two years membership gains since October 1, 1953, total 1,602 for a net gain of 14.5% since that time. Our net increase as of August 24, 1954, over October is actually 738. Chapter are attempting to secure 276 new members before October 1, 1954, which would make a net gain of 20% for the year or period between conventions.

Of interest to many and indicative of the personnel changes that have been made during the past year is the fact that 814 active Society members have changed their address since October 1, 1953. Several delinquents have addresses unknown to the national office at the present time.

Following is a list of Society memberships by states as of August 24, 1954.

Ia.	295	Ind.	64
W. Va.	274	Ark.	59
Tex.	249	Mo.	57
Mich.	242	Miss.	55
Fla.	214	Tenn.	53
Wis.	206	Utah	46
N. C.	202	Mont.	43
Nebr.	190	Mass.	39
N. Y.	183	Vt.	35
Ill.	178	P. R.	29
Penna.	176	La.	28
Calif.	172	Conn.	27
Kans.	167	Ida.	25
N. Dak.	167	N. H.	25
Okla.	144	Me.	19
Md.	141	Nev.	16
Colo.	138	Wyo.	13
Ky.	136	Del.	11
S. C.	125	R. I.	11
S. Dak.	121	Hawaii	8
Ohio	115	Alas.	3
Minn.	113	Ont.	77
Wash.	103	Sask.	11
Va.	101	Alba.	9
N. J.	91	Man.	9
D. C.	89	B. C.	6
Ga.	89	N. S.	5
Ala.	80	Que.	3
N. M.	75	Foreign	239
Ariz.	70	Nebr. Stud.	41
Ore.	65	Mich. Stud.	11
		Calif. Stud.	12
		Total	5,800

MORE FOR '54!



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Industry's Stake in Conservation
. . . Walter C. Gumbel

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. . . L. A. Jackson and H. E. Van Arsdall

Book Reviews: Conservation in Canada; David's Ranch; Limestone; also Helpful Books from Advertisers

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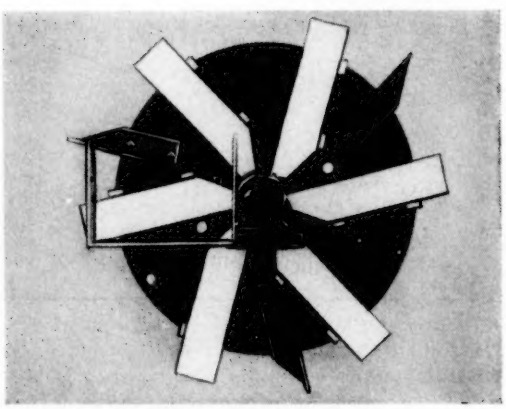

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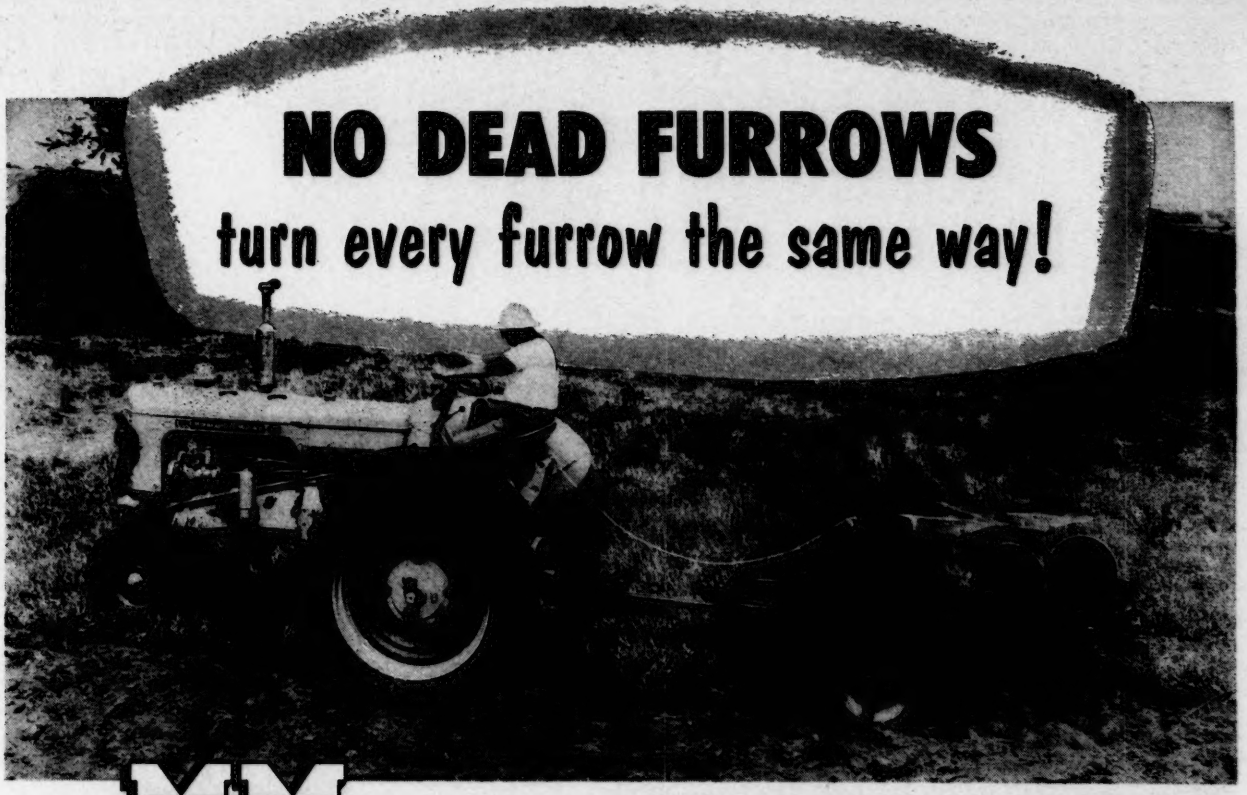

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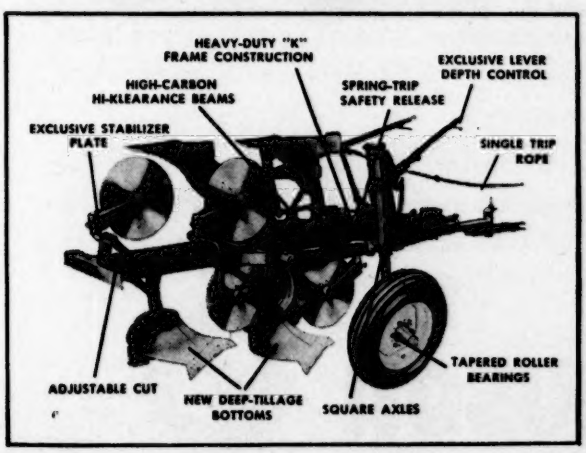

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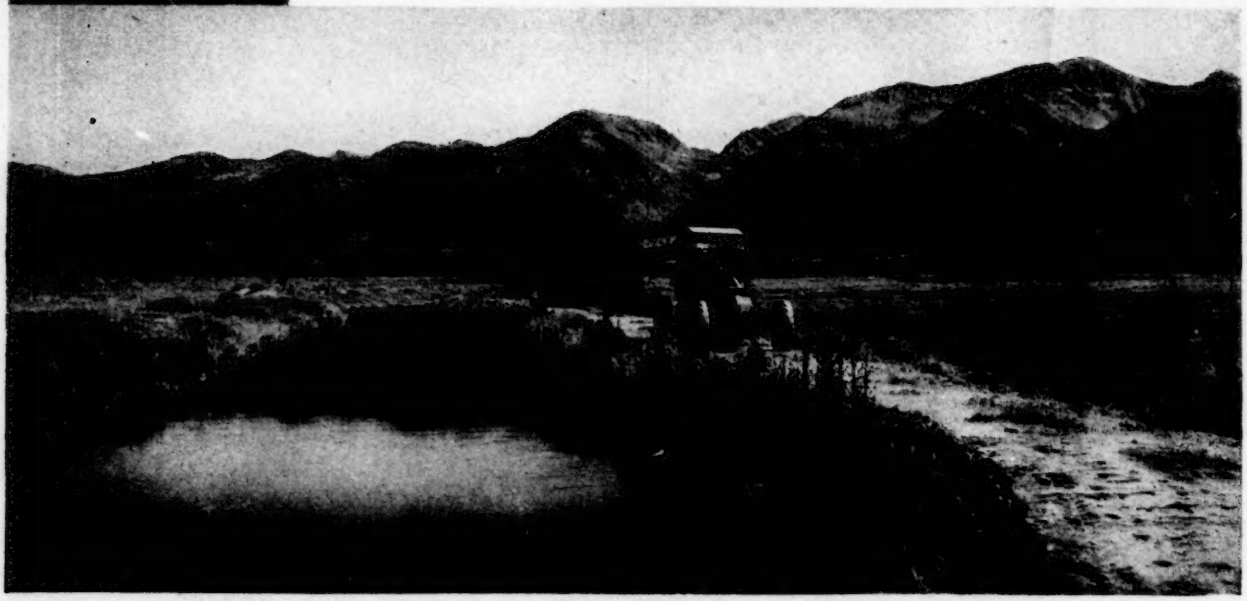

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Journal of SOIL AND WATER CONSERVATION

VOLUME 9
NUMBER 5

TO ADVANCE THE SCIENCE AND ART OF GOOD LAND USE

This JOURNAL is the official organ of the Soil Conservation Society of America. It is owned, edited, and published bi-monthly by the Society.

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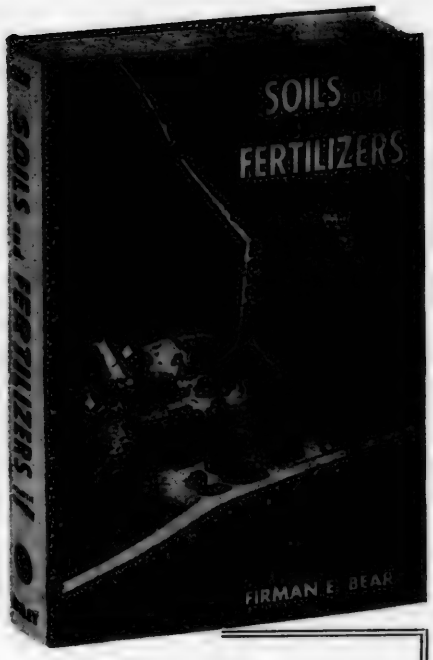

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Reed Canarygrass Heals Gullies

V. B. HAWK, H. D. HUGHES AND F. W. SCHALLER

This is the story of the use of reed canarygrass in the soil conservation districts of Iowa—the history of its early use; its establishment from seed, sods and stems; pertinent research studies; supplementary practices and structures; specialized uses; maintenance of established waterways, and case histories of a few of the many successful reed canarygrass gully control plantings.

GULLIES ARE SCARS on the face of our farm lands. They are stark, ugly evidences of erosion that has been accelerated by poor land management. Perhaps nothing gives a conservation-minded individual more satisfaction than to eliminate them and to develop useful grassed waterways in their place. For gully control, in Iowa at least, one grass stands at the top of the list of plant materials. It is reed canarygrass.

Early Use in Iowa

Reed canarygrass was studied at the Iowa Experiment Station in the 1920's, with particular emphasis on its use for pasture and hay and on poorly drained soils. Its vigorous growth, high yields, and ability to remain green during the summer were soon recognized. Although first thought to be primarily a wet-land grass, its ability to do well on dry sites was observed during drought years. In those dry years reed canarygrass produced more green feed on upland soils than other grasses grown under the same conditions.

Thus, reed canarygrass was not new to Iowa when soil conservation demonstrations were established in the 1930's. Information was available on its adaptation, culture and forage value. Limited quantities of seed could be purchased through commercial channels. The use of reed canarygrass for erosion control, particularly gully control, however, was practically unknown.

Paul Strickler, a farmer in Appanoose County, Iowa, and later an employee of the Soil Conservation Service at the Shenandoah Demonstration Project, is credited with the first use of reed canarygrass for gully control (10). From his observations and experience in vegetative propagation of reed canarygrass he conceived the idea of using small sod pieces for gully control in 1935. A number of gullies were on his farm in southern Iowa and new ones were developing. Small sod pieces were transplanted in these gullies with a spade, in somewhat the same manner as tree stock is planted. A dense cover of reed canarygrass developed rapidly and the gullies were successfully controlled.

Photo by Soil Conservation Service

Figure 1. Reed canarygrass growing in water in the bottom of a gully which is being stabilized. For such use this grass is in a class by itself. It will stand flooding, silting and drought. It can be propagated with seed, sods or stems. It will stabilize gullies without shaping and will provide erosion-proof cover on shaped waterways.

Neighboring farmers were impressed with the excellent job of gully control with reed canarygrass on the Strickler farm. They began to get sod from his plantings to control gullies on their own farms. Thus, the idea of a "sod bank" was developed as a source of vegetative planting for gully control.

Robert Bear, a tenant farmer on the Jack Howell farm eight miles northeast of Centerville, got sod from Strickler and thus became another early and enthusiastic user of reed canarygrass for gully control. Several grassed waterways remain today on the farm as a monument to him. He also established reed canarygrass on several acres of lowland subject to flooding, from which he harvested seed and supplied his neighbors.

It was on this field that the ability of reed canarygrass stems or culms to root and establish new plants was first

Virgil B. Hawk, is plant materials technician with the Soil Conservation Service; H. D. Hughes, is professor of farm crops with the Iowa Agricultural Experiment Station; F. W. Schaller, is associate professor of soils with the Iowa Extension Service. All three authors are members of the SCSA.

This Journal Paper No. J-2535 of the Iowa Agricultural Experiment Station, Ames, Iowa, Projects 786 and 1064 is a joint contribution of the Soil Conservation Service, United States Department of Agriculture, and the Agronomy Department, Iowa State College.

Figure 2. Two well established reed canarygrass waterways where there had been large gullies out of control. *Right.* A typical picture of the grass protecting a waterway in an eastern Iowa cornfield. *Left.* This scene is in the Monona-Ida soil association area of western Iowa. With the run-off from large watersheds to be handled, broad waterways with a tough, trick sod is the goal. For this job, reed canarybrass is ideal.

observed in Iowa. L. J. Thorp, a Soil Conservation Service employee, was on the field shortly after a flood in 1946. He noted that where some of the plants had been matted down and covered with silt the mature stems had rooted at the nodes and began to send up new plants. This was the beginning of the "green hay" method of propagating reed canarygrass.

The use of reed canarygrass for erosion control developed rapidly and soon spread to other areas of the state where there were gully problems. A survey in 1944 indicated that farmers were using reed canarygrass in 59 of the 99 Iowa counties (2).

Seeding Reed Canarygrass

Seeding has not always succeeded in establishing reed canarygrass. One reason was the poor quality of commercially available seed. Improper methods of seed harvest and curing caused seed to be low in germination and vitality. Since reed canarygrass seed shatters readily as soon as it is mature, it was often combined early to prevent loss. Such seed would frequently heat in curing and its vitality wauld be lowered. At the Soil Conservation Service Nursery, seed harvested by heading and then threshed after curing had a higher germination than seed combined direct. Also seed harvested by the heading-threshing method maintained its germination for several years when stored in a cool, dry room. Some of these observations at the Nursery have been confirmed recently by research studies in Michigan (3).

When a gully in southern Iowa is filled and shaped into a waterway the resulting seedbed is often on heavy subsoil of Kansas till origin that is low in fertility. Some farmers recognized the fertility problem and applied liberal quantities of barnyard manure. A few began to use mixed fertilizer, such as 10-20-0, on waterway seedings. The experience of these farmers has shown the importance of applying fertilizer to obtain good stands and vigorous plants.

Failures often resulted when seedings were delayed in the spring until June. It was found best under these conditions to plant a temporary cover crop and seed perennial grasses later. Heath (5) demonstrated that corn seeded at the rate of three to four bushels per acre gave an excellent stabilization crop for waterways. Mowing the thickly drilled corn in August killed it and it did not compete with the grass seeded in late summer in the stubble mulch.

Pointers for Seeding Reed Canary

Reed canarygrass has been used successfully to stabilize shaped waterways, diversion terraces, grass flumes and even unshaped gullies.

Most of the reed canarygrass in shaped waterways was established by seeding. Many excellent seeded waterways were observed during a survey of soil conservation districts in 1952 and 1953. Besides building the waterway to standards, these successful farmers observed the following important key practices in establishing reed canarygrass from seed:

1. A firm, clod-free seedbed was prepared; in some cases the topsoil was stock-piled during construction of the waterway and then spread over the surface to form the seedbed.
2. Where natural fertility was low because of exposed subsoil, the seeding was fertilized with manure or commercial fertilizer containing nitrogen.
3. Seed germination was checked before planting. Seeding depth was shallow, about ¼ to ½ inch. Date of seeding was early spring or late summer. Rate of seeding was from 8 to 12 pounds per acre.
4. Often, the seeded waterway was protected by tem-

porary diversion terraces on the sides and above the head of the waterway.

Seeding Without Shaping

During the 1952 and 1953 surveys, a few gullies were observed where the gully and adjacent land were seeded to reed canarygrass without shaping. On the Bess Haney farm in the Jasper Co. SCD, a large gully was set aside as a wildlife area, fenced with multiflora rose and successfully seeded to reed canarygrass. Richard Wilson of the Appanoose SCD has seeded reed canarygrass at the head of two large overfalls. He is depending on natural sloughing to shape and fill the gully head. A. L. Smith of the Monroe SCD is using this method to gain control of a large gully through a timbered area. Some control has been obtained in a 5-year period, especially on overfalls that were eating back from the main gully.

Volunteer Seeding

It may be possible to stabilize unshaped gullies by volunteer reed canarygrass from an upstream seed source. Control of gullies by volunteer reed canary is a slow process. It will occur eventually, however, if the gully is protected from grazing and if there is a seed source. Such a method could be combined with the control of gully heads and overfalls with reed canarygrass plantings on large gullies where the cost of shaping and filling might be excessive.

Several cases of gully stabilization from volunteer seed were observed in the 1952-53 surveys in soil conservation districts. In all cases, the gully had been protected from grazing. John Foecke of the Lee Co. SCD planted reed canarygrass at the head of a gully in 1945. By 1953 a good stand was established in the gully below for a distanec of over 20 rods. On the Arch Keen farm in the Decatur Co. SCD, a seeding containing a small amount of reed canarygrass in the mixture was made about 15 years ago. In 1952 the reed canarygrass was observed to have spread downstream about 500 feet, covering a strip about 100 feet wide. In 1944, Merlin Brewer of the Jasper Co. SCD seeded ⅛-acre at the head of a gully in a 25-acre watershed. The gully below was not shaped and had a four to five per cent slope. By 1949 the gully was well sodded for a distance of 30 rods below the original seeding.

Sprigging Reed Canarygrass

Farmers and technical people have given considerable attention to vegetative propagation of reed canarygrass in gully control work. This method has an advantage over seeding when there is danger of the seed and seedlings being washed away by a heavy rain before they become established. Small sod pieces, or sprigs, firmly heeled in, with the crowns an inch or so below the surface, are

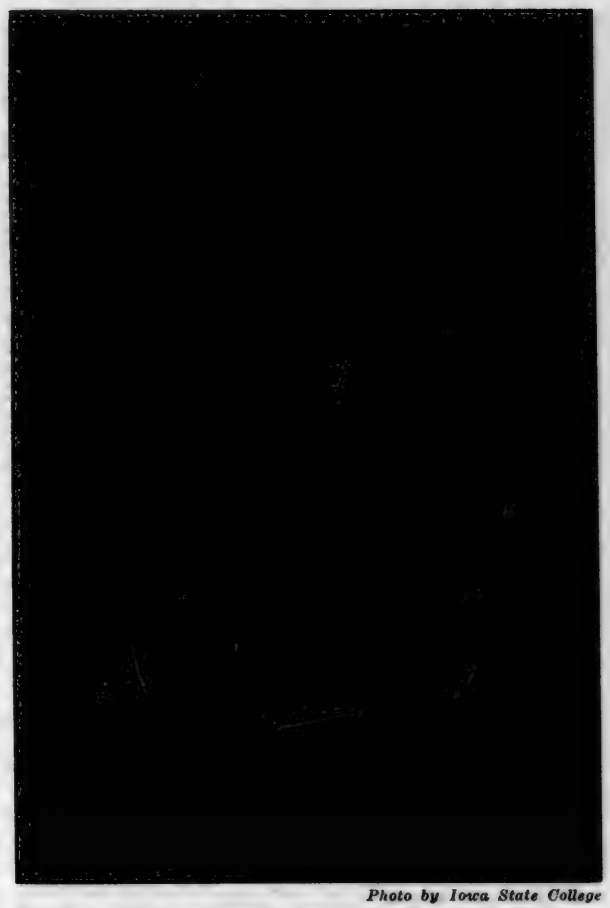


Photo by Iowa State College

Figure 3. Reed canarygrass sprigs. Small sods of the grass, with perhaps only one or two shoots, are ideal for establishment under conditions where seed and seedlings would be washed out with the first rain. In unshaped gullies, the small sods are dropped into V-shaped slots made with a flat spade and firmly heeled in. On shaped waterways, they can be distributed with a manure spreader, disced to cover, and the soil firmed with a roller.

silted over by the same sort of rains and become established under ideal conditions. It has been shown that small sod pieces, perhaps with only one or two shoots, properly imbedded a little below the surrounding surface, give better results and are much more economical in labor and materials than larger pieces of sod. The larger sods are costly in both labor and material. Too often they cannot be properly placed, with the result that eddying water undercuts them and prevents proper establishment where wanted.

The "Sod Bank" Idea

The soil conservation districts took hold of the "sod bank" idea and encouraged their establishment. "Sod banks" are small plots of reed canarygrass, perhaps only 1/10 to 1/4 acre in size. They are established by seeding

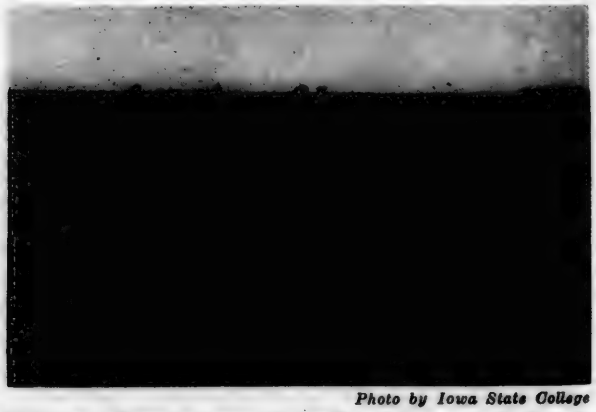


Photo by Iowa State College

Figure 4. Alternate rows of small sod pieces and of soil-covered culms placed at weekly intervals from early June to early October at the Agronomy Farm, Ames, Ia. These research studies demonstrated that either kind of material can be used for establishment at any time when moisture conditions permit.

reed canarygrass on a good seedbed in the spring or on summer fallow in late August, at a rate of eight to ten pounds of seed per acre. The plot is located conveniently on a fertile upland soil where the reed canarygrass will make vigorous growth and where rhizomes may be dug with ease throughout the growing season. Under such conditions, sods may be taken from the planting the following summer. Thus, there is established in a local community a source from which neighboring cooperators can get sod for gully control.

Seed for the establishment of these "sod banks" often was supplied to cooperators by the soil conservation districts in return for a promise that sod material would be made available to the neighborhood group. Soil conservation districts obtained seed by purchase with district funds, or from the Soil Conservation Service.

Seed was supplied by the SCD from Nursery production of the named variety, Ioreed. Ioreed canarygrass is a synthetic variety developed by the Iowa Agricultural Experiment Station. (8). By 1950 sod banks of Ioreed canarygrass had been established in 68 of the 100 Iowa soil conservation districts.

Mechanization of Sod Planting

Increased use of reed canarygrass sods for gully control led to the development of mechanized methods of planting. A popular mechanized method consitsts of the following steps:

1. Mow the plot of reed canarygrass and remove the cut material.
2. Plow the land as shallow as possible—usually to a depth of three to four inches.
3. Tear up the plow slices with a disk, or by other means.
4. Load the sod onto a manure spreader with a hydraulic manure loader.
5. Spread the sod on the previously prepared waterway with the spreader at the rate of 15 to 20 tons per acre.
6. Cover and pack the sod into moist soil, either by disking or shallow plowing followed by rolling with a cultipacker.
7. As double insurance, the waterway may be overseeded with a waterway mixture.
8. Sodding is best done during early spring or late summer, when temperature and moisture conditions are favorable to growth of cool-season grasses.

Smith, in Missouri, developed an experimental planting machine for reed canary rhizomes (4). It consists of a one-row middlebuster fastened onto an "A" frame for a tractor with a 3-point hitch. The shovel makes a furrow about four to five inches deep. Fertilizer is applied in the bottom of the furrow from a box and a spout mounted on the machine. A trailer behind the furrow opener seats two men who drop reed canary sprigs into the furrow. Metal bars under the trailer platform close the furrow and the next trip the tractor wheel runs on the row and firms the soil.

One of the outstanding waterways established by mechanical spreading of sods was observed on the Walter Krauter farm in the Lee Co. SCD in southeastern Iowa. A gully which drained a 95-acre watershed of Grundy-Haig soil, with average slopes of five to ten per cent, had been giving Mr. Krauter trouble for some years. In 1950 he shaped 500 feet of the worst part of the gully into a parabolic shaped waterway that is 30 feet wide and three feet deep and has a one per cent slope. Reed canarygrass sod was distributed with a manure spreader and the waterway mulched. By 1953 there was a perfect stand of reed canarygrass and the gully was under control. Mr. Krauter used the same method in 1951 on two other gullies with equal success.

A compromise between seeding and sodding was used by L. P. Curtiss of the Lucas Co. SCD in southern Iowa. He seeded reed canarygrass on the undisturbed banks of a gully four to five feet deep and eight to ten feet wide. The banks were pushed in with a bulldozer after the reed canarygrass became well established. A shaped waterway was constructed, taking care not to bury the reed canarygrass sods. An excellent stand of grass developed from the rhizomes, and it has withstood runoff from a large watershed for several years. The size of the watershed and estimated amount of runoff was such that the highway engineer designed a 3-foot road tube to handle the flow of water.

The "Green Hay" Method

The "green hay" method of vegetative reproduction is unique in that it is based on the ability of this grass to develop new plants at the nodes of the stems. When reed canarygrass matures its seed in the latter part of June, the mature culms do not die but remain alive and green through the summer. When covered with moist soil or water, roots and plants develop at the nodes. This is one of the reasons reed canarygrass withstands siltation so well.

By using culms instead of rhizomes for the vegetative propagation of reed canarygrass, both the weight of the material to be handled and the amount of labor are markedly reduced. The main requirements are that: (1) fully developed culms be used; (2) the soil of the planting site be moist, or preferably wet, and (3) the culms be planted promptly after cutting, without permitting them to dry out.

Following up on Thorp's observation, Heath (6) in 1947 planted 3-node cuttings of reed canarygrass in moist soil, leaving one node above the ground surface. He found that plants developed from the first node below the ground surface. He concluded that if the green hay is covered with approximately two inches of moist soil soon after mowing new plants will develop from the nodes.

In 1949 the Iowa Agricultural Experiment Station (7) made a thorough study of the technique of establishing reed canarygrass from "green hay", comparing this method with establishment from the use of sprigs. It was found that new plants could be established from culms cut off and planted immediately in moist soil any time between late June and early October. The data indicated that mature culms are likely to produce the most shoots, and that the first three nodes from the base will produce more shoots than those further removed from the base. Shallow planting, two inches deep, was superior to planting four inches deep. Growth was not established as quickly by propagation with culms as with sods, however. Also, the period during the growing season in which the grass can be propagated by culms probably is considerably shorter than the period for successful propagation by sods.

The most extensive use of the "green hay" method has been in constructing waterways on the Little Sioux Flood Control Project in northwestern Iowa. As reported by Blakely (1), George Harmon, Agronomy Specialist, SCS, began to use the method in the summer of 1952. He found that it was highly successful whenever used in waterways where there was running water, seeps, or muddy soil. Such conditions exist in many deep gullies in the Ida-Monona soils of western Iowa after filling, shaping and the construction of flood control structures. His success has led to renewed interest in this method and its adoption by farmers in the area.

Photo by Soil Conservation Service

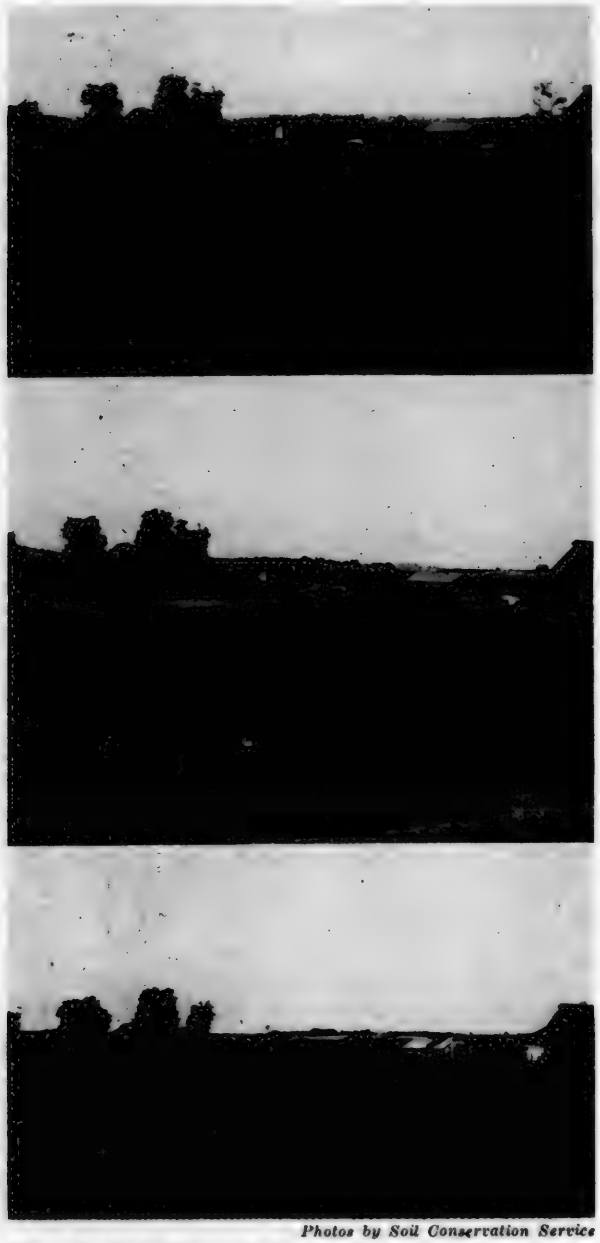
Figure 5. The "green-hay" method of establishment is being used in extensive waterway plantings in the Little Sioux Flood Control Project. As shown here, ideal moisture conditions prevail when very deep gullies are filled and shaped.

Reed Canarygrass Flumes

Reed canarygrass flumes show considerable promise as an inexpensive method of controlling overfalls and erosion on steep grades. A number of grass flumes have been used in southern Iowa soil conservation districts.

Three successful flumes were observed in the Wayne Co. SCD. On the Brick and Boyer farm near Corydon, a reed canarygrass flume was constructed by pushing in an 8-foot deep gully head in 1947. The cost of the bulldozer work was $100. The flume was protected by a diversion terrace. The Shelby subsoil was fertilized with a complete fertilizer and reed canarygrass seeded on the flume and diversion terrace. The seeding was protected from grazing damage. This gully head is now stabilized and runoff water from a 40-acre watershed is being handled.

John Moore of Allerton built a reed canarygrass flume at a cost of $65 in 1944. This flume is 150 feet long and has a nine to one slope. The gully had been eight to ten feet deep before "dozing" and handled water from a 53-acre watershed. The seeding on this flume was protected by a diversion terrace. Chicken manure and commercial fertilizer were used to build up the fertility of the raw subsoil. The flume has been grazed since establishment and cattle have caused some damage at the lower end.



Photos by Soil Conservation Service

Figure 6. *Top.* The original gully; *Center,* the shaped waterway ready for establishment of the cover; and *Bottom,* the thick sod of reed canarygrass. These scenes of conservation in action were taken on the Clyde Milner farm in the Marion County Soil Conservation District, Iowa, in 1945, 1946 and 1950, respectively.

Lloyd Greenlee, who lives northwest of Allerton, built a reed canarygrass flume at the lower end of a large waterway in 1948. The watershed exceeded 50 acres and a structure would normally have been recommended. Five years later the flume was observed to be in excellent condition.

Two successful flumes were observed in the Jasper Co. SCD. B. Wormley, a cooperator from Newton, built a flume in 1949 which was 75 feet long with an eight per cent slope. The flume is five feet deep, has a top width of 30 feet and a bottom width of 20 feet. It was sodded with reed canarygrass and an excellent cover obtained. Since 1949 the flume has successfully handled all the runoff from an 80-acre watershed of Mahaska silt loam with a seven per cent slope. R. Poage, near Baxter, built a flume in 1950 and sodded it with reed canarygrass. The flume was 50 feet long, 25 feet wide at the top, 15 feet wide at the bottom and has a ten per cent slope. It has handled the water from a 20-acre watershed of Tama and Shelby silt loam with a nine per cent slope.

Shotwell (9) reported that a reed canarygrass flume was constructed at the end of a terrace outlet on the farm of Dean Parker in the Shelby Soil District in northeastern Missouri. The cash outlay for the flume was only $80 and it replaced a concrete structure which was estimated to cost $1,000.

Other Considerations

There are three spots where reed canarygrass can be used effectively with farm ponds. *First,* it is one of the best grasses for the protection of the banks from wave action. *Second,* it provides an erosion-resisting, permanent grass cover for the emergency spillway. *Third,* planted above the pond it will filter out large quantities of silt before runoff water reaches the permanent reservoir.

A combination of reed canarygrass and small structures offers considerable promise in reducing costs of erosion control without a loss in effectiveness. Even in the best reed canarygrass waterways there may be need for a structure where there is a sharp change in the characteristics of the waterway. The toe wall dam, or a small drop spillway, would be suitable structures under such conditions when reed canarygrass and structures are used together for gully control. Toe wall dams are used to provide a transition from a wide, flat, sodded waterway to a narrow-bottom, wet-bottom or a rock-bottom draw.

Maintenance of Waterways

Reed canarygrass is long-lived and has unusual ability to recover from damage in waterways. Maintenance, therefore, is not a big job but problems sometimes develop which require special attention. For example, rills may develop in a waterway seeding during establishment. These rills can be quickly patched with reed sods before serious damage results. Rills also may develop on old stands of reed canarygrass on very steep grades. These can be repaired by spading in rhizomes from the side of the rill.

Excessive siltation sometimes occurs in a waterway channel planted to reed canarygrass. Excessive siltation is especially apt to develop if the waterway was improperly designed or if conservation practices on the watershed were inadequate. The silt deposition raises the center of the waterway and "twin gullies" may develop on either side of the waterway. The only solution is reshaping. This can be done with a plow, with the old reed canarygrass sod being worked into the bottom of the waterway. If the sod pieces are covered with moist soil not more than eight inches deep, they will root and rapidly reestablish cover. The best time for such repair is late August or during September.

Too many instances have been observed where livestock have damaged waterways. Hogs are especially destructive and should be excluded. Overgrazing by cattle or sheep, or excess tramping when the soil is wet, may weaken the grass cover and encourage rilling. On the other hand, moderate grazing or periodic mowing is usually beneficial.

Reed canarygrass waterways may become sodbound for want of available soil nitrogen. This is especially apt to happen when a full set of conservation practices have been applied on the watershed. If the reed canarygrass produces a stunted yellow growth, does not head out, and the plant cover it produces becomes sparse, the waterway should be top dressed with manure or fertilized with nitrogen. Usual rates are 150 to 300 pounds of ammonium nitrate or its equivalent per acre, applied either in the fall or early spring.

Woody plants in a waterway interfere with mowing, divert water out of the planned channel and shade out the reed canarygrass. Trees should be cut and the stumps treated with chemicals. Brush and small trees can be controlled by spraying. Control of woody plants is an especially serious problem in gullies planted to reed canarygrass without shaping.

Summary

Where there is a need for gully stabilization, reed canarygrass can do the job. For such use, this grass is in a class by itself. It will stand flooding, siltation, and drought. It can be propagated with seed, sod, or stems. It will stabilize gulleys without shaping and provide an erosion-proof cover on shaped waterways.

The best summary of all that has been said here will be found on the Ernest Harms farm near Underwood, Iowa. Mr. Harms, a commissioner for the West Pottwattamie Soil Conservation District, followed all of the recommendations and exercised unusual care in establishing a large grassed waterway. Starting with a gully 15 to 20 feet deep and 30 to 40 feet wide in the erodible Ida-Monona soils of western Iowa, he shaped it into a waterway, tilled it and planted a mixture containing reed canarygrass in the fall of 1946. The waterway was 60 to 80 feet wide, about one-half mile long, with a 60-rod lateral and covered eight acres. The watershed consisted of 300 acres with an average slope of 10-12 per cent. An overfall at the lower end of the gully was stabilized with an 8′ x 10′ box type drop inlet with an 18″ tube. The new seeding was protected by temporary diversion terraces along the sides of the waterway. Run-off was reduced by a soil-conserving rotation of C-C-O-M-M-M on the cropland, terraces, contour planting of corn, and conservative management of pasture lands. After an excellent grassed waterway was established, it was maintained by frequent inspections and repairs. As trouble spots developed, the rills were repaired with reed canary sods.

With proper establishment, use of a supplemental structure, conservation practices on the watershed, and consistent maintenance, a reed canarygrass waterway has taken the place of a canyon-like gully in the loessial soils

(Continued on page 237)

Photo by Soil Conservation Service

Figure 7. Ernest Harms standing where there had been a gully 15 to 20 feet deep and 30 to 40 feet wide. It was shaped and seeded to reed canarygrass in the fall of 1946.

Progress in Grassland Agriculture in the Southeast

TED C. MAURER AND BARRINGTON KING

Cropland in the southeast is one of the important new frontiers in the field of soil and water conservation. It is not enough, the authors point out, to bring erosion under control. The productive capacity of our soils must be increased to meet the needs of a rapidly increasing population.

IN ASSESSING THE PROGRESS of good land use and soil conservation in the Southeast, severe summer droughts of the past three years cannot be overlooked. In the rapidly developing livestock industry of this section, farmers without kudzu or sericea, bottomland pastures, or irrigated supplemental annual crops have been hard hit. Many had to buy hay and concentrates.

But it's an ill wind that blows no good, and the same might be said of droughts. During the high price of cattle, wild enthusiasm for fescue and ladino clover put this grass and legume on a lot of poorly adapted sites where it was not recommended. The recent droughts have brought home to Southeastern farmers that land capability means just what it says. Certain lands will grow one grass or legume better than other lands.

While recent droughts have been unusually severe, there is usually at least one period almost every summer when upland pastures suffer for moisture. Fortunately, the South has pasture plants that carry cattle through ordinary dry periods on well-planned farms where both land and plants are used according to their capabilities and treated according to their needs. Even a casual observer during the past three summers could not help but note the dark green color of sericea and kudzu standing out like oases on many otherwise parched farms.

Sericea is well adapted on uplands where grasses burn up during dry periods. Kudzu fits well on well-drained, severely eroded uplands that cannot be mowed for brush and weed control. Kudzu does a good job of controlling such growth. Much of the land that should be in kudzu has not produced profitable crops during the past five years. The three successive drought years have compelled farmers and agricultural leaders to re-assess the value of these two deep-rooted perennials in a sound grazing program.

There has also been a reappraisal of the carrying capacity of all the adapted grasses and legumes. Hay and grass silage made during the lush spring growth is a needed assurance of sufficient feed for low cost production of beef and dairy products.

But there are other plants that have considerable drought resistance when planted on adapted soils. Following the 1952 drought, the Soil Conservation Service asked work unit conservationists who had observed pastures on thousands of farms in nine Southeastern States what pastures stood up best under the dry weather and heat. A summary of more than 600 replies showed that sericea, Coastal Bermuda grass, lowland pastures, kudzu, and Pensacola Bahia grass stood up best. Fescue, orchard grass, Johnson grass, alfalfa, and annual lespedeza came through in fair to good condition. Strong, vigorous sods that were liberally fertilized, moderately grazed, and mowed for weed control stood up better than overgrazed or unfertilized pastures. Proper stocking is a *must* in every well managed grazing program.

The recent droughts, instead of being deterrents to progress, should be considered as a part of the growing pains of the expanding livestock development of the South. They have taught us in a few years lessons that might otherwise have taken a much longer time to learn. These droughts have put a premium on using land and plants according to their capabilities; also on understanding the growth characteristics of the adapted plans under varying conditions of soil, moisture, temperature, and management practices. These observations have helped to determine more accurately the acreage of each grass and legume needed to provide the feed during critical drought periods.

Stronger conservation rotations, which include perennial grasses, are rapidly being accepted and used ahead of the row crop. This good conservation practice is rapidly spreading over large areas because farmers have observed and talked about the many good effects that follow such a practice. You can be sure it is catching on when the Soil Conservation Service work unit conservationists tell you that farmers are asking them to help work out a grass rotation like Mr. So and So has. Then, when you hear another farmer get really enthusiastic about how that field held all the water from one rain while another field without grass turned under had the terraces running almost full, you know they have conservation as a way of life.

This practice has given new impetus, especially where grasses have been planted on poorly adapted sites. Dur-

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Ted C. Maurer, agronomist and Barrington King, information specialist, are employees of the Soil Conservation Service. Both men are assigned to the southeastern states and are headquartered in Spartanburg, South Carolina.

Figure 1. *Left.* Turning Bahia grass sod for tobacco in the Atlanta Soil Conservation District, Georgia. *Right.* Despite severe drought, a good stand of cotton was obtained in a fescue-ladino rotation in this field on the Peden Gaston farm near Spartanburg, South Carolina.

ing favorable seasons when the importance of adapted soils was less apparent, farmers continued to use these areas for pasture. But with drought conditions severely affecting pasture yields, many of these areas where grass was already established are being plowed for grass-based rotations.

Research is playing an important part in improved rotations. Exploratory rotations at Watkinsville, Georgia, in which tall fescue and ladino clover were seeded in the fall on newly planted small grain and left there on the land two or more years after the grain was harvested, were successful. Satisfactory stands of grass followed the grain and when the sod was turned under and followed by cotton or corn, the yields were good. Soil tilth and organic matter content also improved under sod.

Rotations based on perennial grass are attracting favorable attention in some of the flue-cured tobacco areas of North Carolina. Growers who tried such rotations were pleased with the yield and quality of tobacco following sod. They also noticed less disease and nematode damage to tobacco following sod than under other conditions.

Even in the new grass empire of Florida, perennial grass is being used to a limited extent to rotations with watermelons and tomatoes. Formerly, the farmers grew one crop of melons or tomatoes and left the land idle for several years so as to reduce disease. They now plant Pensacola Bahia grass, pasture it five years, and plant melons or tomatoes again.

For many years, Florida was noted for its large number of low-grade range cattle. Native wiregrass and scrub palmetto range was almost the only kind of pasture to be found in the Peninsula of Florida in 1945. Farmers and ranchers asked their soil conservation districts for help. Simple field trials, planted by state experiment stations and Soil Conservation Service technicians, were carried out by farmers under the guidance of field workers.

As a result of what they learned from these trials, Soil Conservation Service workers knew what grasses to plant on different soils and enough about liming and fertilizing to make grass grow. The state experiment station furnished stolons of Pangola and Coastal Bermuda grasses. The former nurseries of the Soil Conservation Service produced seed of Pensacola Bahia grass and allotted enough to each soil conservation district to make one or more five-acre observational planting. District supervisors selected farmers and ranchers who could be depended upon to take care of the initial supplies of grass stolons and seed. Soil Conservation Service field workers helped farmers and ranchers with the details of planting their first grass and then the farmers expanded their plantings.

Today, there are approximately a million acres of improved grasses planted in soil conservation districts in Florida. This acreage is being expanded very rapidly. A new development is the irrigation of certain lands for winter production of clover pastures. The winters are too dry for clover, but irrigation insures farmers, particularly dairymen, enough green feed in winter. Along with pasture development has come an almost unbelievable improvement in cattle. With introduction of improved breeds, principally Brahma cattle, Florida is definitely in the meat business.

Outstanding development in grassland farming is

Figure 2. Sericea and kudzu have continued to provide good grazing during the severe droughts of the past three summers. This sericea remained green when other grazing crops on the farm were severely damaged by dry weather.

taking place in somewhat smaller areas of other states. One of the most striking signs of this movement is the large increase in fenced fields along the road. Many sections where only an occasional field of eroded land that was no longer fit for cultivation was under fence now have more than 50 per cent of the previously cultivated land fenced.

It is quite interesting that this trend toward fencing cropland follows a natural, logical land use pattern. In areas where slopes are moderate and soils are still favorable for the production of cultivated crops, the percentage of fenced land is low. In areas where slopes are steep, or where because of other unfavorable soil conditions the land is not well suited for cultivated crops, very high percentages of the land are already under fence.

Strangely enough, one of the most extensive grassland developments is taking place in the Mississippi Delta, long recognized as the stronghold of cotton. Poorly drained soils that are not well adapted to cotton make excellent grass and clover pastures. Such land is rapidly being converted to grass.

New plants have been brought into Southern agriculture and new uses have been developed for grasses and legumes that were already in use. Kentucky-31 fescue is now widely recognized as a vigorous grass that furnishes green pasture in winter. It was first planted by the Kentucky Agricultural Experiment Station in 1931 and later seed was furnished to other Southern stations for trial plantings. It was widely distributed by former Soil Conservation Service nurseries to soil conservation districts. Plantings were made in nearly 700 counties between 1943 and 1948.

The Georgia Coastal Plain Experiment Station, working in cooperation with the Bureau of Plant Industry, Soils, and Agricultural Engineering of the U. S. Department of Agriculture, gave the sandy Coastal Plain areas of the South the vigorous new perennial grass, Coastal Bermuda. This grass is meeting the need for a vigorous summer pasture grass that will protect sloping land from erosion and furnish feed for livestock. Soil conservation districts played an important part in the distribution of Coastal Bermuda by arranging with selected farmers to establish small grass nurseries of the stolons. Districts bought grass planters that reduced the cost of planting and conducted "grass digging days" in several localities.

Pensacola Bahia grass is another vigorous perennial that has come into wide use on sandy soils during the past fifteen years. Coastal Bermuda and Pensacola Bahia are being studied in rotation experiments at Tifton, Georgia, by the Georgia Coastal Plain Experiment Station, and B.P.I.S.A.E.

Pangola is a perennial crabgrass that came into Florida through the cooperative grass work of the State Experiment Station and the Bureau of Plant Industry. Soil conservation districts, with the help of the Soil Conservation Service, the experiment stations, and the Extension Service, conducted trial plantings to see what Pangola would do under their local soil and climatic conditions. Results were so good that a vigorous campaign, which included grass-digging days, was carried on to get this new grass into use. Pangola is now growing on a high percentage of the farms in the Florida Peninsula, where it was virtually unknown as late as 1945.

Grasses are most useful, of course, when grown in combination with legumes. Fortunately, the South has been blessed with a large number of adapted legumes. Crimson clover is one of the most widely useful legumes in the South. Farmers, state experiment stations, and the Bureau of Plant Industry of the USDA worked together to give us reseeding kinds of crimson clover that fit perfectly in combinations with such summer grasses as Bermuda, both common and Coastal; Pensacola Bahia grass; Italian ryegrass: and rescue grass, an old grass in the South that has come into extensive use during the past ten years.

Ladino clover is not exactly a new legume in the South, but it has come into widespread use during the past fifteen years. It is the natural companion for grasses like orchard and tall fescue. Ladino fits well

into rotation mixtures with red clover. Ladino takes over after red clover fades out of grass-legume mixtures, thus maintaining the desired grass-legume combination until the sod is plowed for cultivated crops.

Sericea lespedeza is another legume that has come into extensive use during the past fifteen years. Pioneer research with sericea at the Tennessee and Alabama Experiment Stations gave us valuable information about the culture and use of this legume. Soil Conservation Service workers in soil conservation districts put together the information the stations could give them and developed successful methods of seeding sericea and harvesting it for hay. They found sericea useful as a protective ground cover on sloping land and as dry-season summer pasture. The demand for seed in 1954 was far beyond the available supply.

State experiment stations have made great progress during the past ten years in finding the cultural requirements for alfalfa under different soil and climatic conditions. As a result of their findings, alfalfa is contributing to a better balanced farm and livestock program in many areas where ten years ago it was considered to be entirely unadapted.

Button clover started moving in a really big way during the past ten years, largely as a result of improved methods of harvesting seed. When we learn a little more about its cultural and management requirements, it promises to be extremely valuable as a reseeding legume for use on cultivated cropland where row crops are grown intensively.

Kudzu, Caley peas, grandiflora vetch, smooth vetch, Kenland red clover, maganese bur clover, and hairy indigo are other legumes that are filling important places in certain localities. Some of these plants promise to be still more useful as we learn more about how to grow and manage them under farm conditions.

One of the important new frontiers in the field of soil and water conservation is cropland. Our concepts of conservation are expanding. It is necessary to bring erosion under control, but that is not enough. We must go deeper than simply saving the surface. The productive capacity of our soils must be increased if they are to meet the needs of a rapidly increasing population.

Improved rotations provide our best opportunity for building a high level of soil productivity. The extent of this opportunity is illustrated by the fact that in the extensive row-rop producing states of Alabama, Georgia, South Carolina, and North Carolina we have about 41,345,000 acres of cultivated land in capability classes I, II, and III, according to the Soil Conservation Service's 1949 conservation needs data. Improved rotations have been planned and applied on less than one-third of this acreage. Even though this acreage is already under rotations that are a distinct improvement over what farmers previously followed, these rotations are not up to the standard need to do the job of both conservation and improvement that we want. Present trends toward stronger rotations, based on perennial grass-legume sods, indicate that most of our cultivated lands are still somewhat more in the field of opportunity than in the field of actual accomplishment.

Figure 3. Pangola grass in nursery plot operated by supervisors of the Highlands County, Florida, Soil Conservation District. Grass stolons from this plot are used for planting pastures.

Southern agriculture has undergone many changes for the better during the past fifteen years. Both farmers and the professional workers in this important agricultural area have learned a great deal during this period. Much remains to be done in the field of research in order to get the technology that will be required to service this new and ever-changing agriculture.

In addition to research information, we must develop the necessary know-how that is acquired in the field, out on the land. We have much to learn yet about applying and fittting together research information to make a balanced, workable plan for each field. Supervisors and other farmers in soil conservation districts can continue to make important contributions to this job of fitting together, adjusting, and adapting information so that we may get the desired results on the land and in our bank accounts.

Soil Erosion Survey of Latin America

The Conservation Foundation and the Food and Agriculture Organization of the United Nations

This Survey, presented in three parts,* is the result of a cooperative venture between The Conservation Foundation and the Food and Agriculture Organization of the United Nations. Under the technical direction of FAO, field reconnaissance was used to supplement and verify conclusions drawn from geographical correlation techniques. The three maps represent the first real assessment of the degree to which erosion has ravaged Latin American soils. Of necessity, and by design, such a survey must be highly generalized. It is hoped that its findings will stimulate individual nations to study in greater detail the facts and implications of soil erosion within their borders.

Part II
SOUTH AMERICA

The diversity in physical environment which marks the landscape and affects the human pursuits in Central America is carried to even greater extremes on the South American continent. Within the limits of that compact land mass, which straddles the equatorial belt and extends southward beyond the middle latitudes, are contained the world's largest tropical rain-forest basin, the second highest mountain range, a coastal belt of extreme aridity, a windswept plateau of semiarid grazing land and a miscellany of lesser physiographic features and climatic regions. In a survey such as the present one, in which the factors of climate, land form, vegetation, slope, soil type as well as a gamut of cultural factors must be considered in their effect on soil erosion, it is not possible to deal with a continent as a whole, no matter how generalized the results.

Accordingly, the discussion of soil erosion will be presented country by country, beginning with the Andean nations perched atop or straddling the continent's mountainous spine, and ending with the countries that occupy the less diversified eastern regions of South America. It may be argued that the choice of national units for the study of soil erosion is a poor one because of the marked physical and cultural diversity to be found within the confines of any one country. Thus, a cross section of the Republic of Colombia resembles in miniature the east-west cross section of the entire continent: a narrow coastal plain in the west blocked off by the Andean chain; an alternation of high ranges, dissected valleys and intermountain plateaus; and finally the abrupt descent into the tropical rain-forest of Amazonia which occupies the eastern half of the country.

It should be remembered, however, that if the present survey is to stimulate an increased measure of erosion control activity in Latin America, decisions to that effect will have to be made by the respective national governments. That is why the South American part of the soil erosion survey has been organized into a series of national surveys.

VENEZUELA

The diversity of land forms is Venezuela's most distinguishing feature. Within the confines of this, the northernmost South American republic, four major physiographic divisions may be recognized:

1. The Venezuelan Highlands forming the northeastern extension of the Andes
2. The Maracaibo Lowlands, wedged between two Andean mountain prongs
3. The Orinoco Llanos, a gently sloping lowland drained eastward by the Orinoco River system
4. The Guiana Highlands, forming the country's southern and southeastern borders, south of the Orinoco Llanos.

The preparation of the SOIL EROSION SURVEY *was under the overall direction of Dr. Mark Baldwin, consultant on the staff of the Food and Agriculture Organization of the United Nations and formerly of the Division of Soil Survey, U. S. Department of Agriculture. Dr. Baldwin conducted the field work in Mexico, Central America, and the Caribbean. He is a pioneer in the classification of degrees of soil erosion from aerial photographs and this method was used in many areas where field work was not practicable. Under Dr. Baldwin's general direction, the field work in South America was carried on by Charles S. Simmons of the Foreign Agricultural Service, U. S. Department of Agriculture, who covered western South America, and Dr. W. F. van Beers, Soil Scientist, FAO, who covered the eastern part of the continent. The manuscript, submitted by the field staff and revised by Dr. Baldwin, was consolidated and edited by Peter M. Stern of The Conservation Foundation. Part III, dealing with agents of soil erosion, was contributed by Dr. J. G. Steele, Soil Conservation Service, U. S. Department of Agriculture. The maps were drafted from field compilations by F. J. Marschner of the staff of FAO and formerly of the Bureau of Agricultural Economics, U. S. Department of Agriculture.*

*Part I, which appeared in the July, 1954 issue of the JOURNAL, dealt with soil erosion in Mexico, Central America and the West Indies.

The Venezuelan Highlands

A most rugged mountain region of high peaks and steep slopes, the Highlands are surrounded by somewhat more gently sloping bench lands which gradually merge into foothills and a rolling piedmont in the direction of the Orinoco Llanos. The Highlands may be classified into two sections: (a) the western and eastern prongs which constitute the true extension of the Colombian Andes and flank the Maracaibo basin on the west and on the south; (b) the northern ranges whose coastal spurs and outliers reach all the way from Maracaibo to the Gulf of Paria, opposite the island of Trinidad.

In the higher western and southern prongs very little of the land is level, or even nearly level, with the result that perhaps 75 per cent of the cultivated area is found on slopes with gradients exceeding 25 per cent. Because of the region's forbidding topography and the shifting type of agriculture prevalent in it, most of the cultivated land has been severely eroded and much of it has been abandoned. The lands of gentler gradients have suffered erosion ranging from moderate to severe depending on their history of land use. There has been some erosion as a result of overgrazing, particularly in the drier, northern sections of the Highlands. Most of this region was originally in forest and its reclamation must be accompanied by systematic reforestation.

The northern and coastal Highlands are much less rugged, but even here the land under cultivation is sloping, hence subject to erosion when cleared. Only about 10 per cent of the area is nearly level or gently sloping, and it is in these more favored intermountain basins and river bottoms that intensive agriculture is carried on. Outside of these oases of permanent estate agriculture, the principal form of land use for many centuries has been shifting cultivation marked by the use of fire in clearing the vegetation and cleaning up crop residues. Little truly virgin soil remains on these mountain slopes, and no more than 15 per cent of the area is usually in cultivation at any one time. While this is a necessary expedient for an impoverished population, the practice has contributed to the severity of soil erosion in the Venezuelan Highlands. Corn, the chief subsistence crop on sloping lands, is almost invariably a serious soil-depleting agent, partly because it is a direct cause of erosion in the small clearings in which it is grown in rows up and down the hillside, and partly because it does not contribute to the return of organic matter to the soil.

Perhaps the most serious result of shifting cultivation is the failure of the original forest to return and to regenerate the land. Many observers have noted that a scrubby growth of poor species and, in the drier sections, cactus invade the abandoned lands. In the drier uplands, especially in the vicinity of larger cities, the practice of pasturing large flocks of goats has also contributed to a severely reduced carrying capacity.

The Maracaibo Lowlands

This coastal plain ensconced between the two Andean ranges has a uniformly tropical temperature regime but a rather wide range of rainfall. Thus, in the south the rain is adequate to foster a dense tropical forest, whereas along the shores of the Caribbean a xerophytic scrub-forest vegetation is supported by a scanty 10 to 20 inches of rainfall. Soil erosion south and west of Lake Maracaibo is insignificant except in small areas, but between the northern shores of the lake and the sea much of the land has been severely eroded, apparently as a result of overgrazing. Erosion in this drier section is partly geological, but it has undoubtedly been accelerated by the importation of sheep, goats, and cattle since the Spanish conquest.

The Orinoco Llanos

This vast plain ranges in elevation from about 700 feet at the foot of the Andes to sea level in its eastern portion, but the slope is so gradual that the land is practically level everywhere. Grass is the dominant form of vegetation, with both short grass and tall grass species represented along with a scattering of trees in the more humid parts. The climate is marked by an alternation of extremely wet and very dry seasons, June—October and January—March, respectively. Despite the unfavorable distribution of rainfall and the presence of insect pests typical of most tropical savannas, the Orinoco Llanos are an important grazing land with a cattle population numbering in the millions. There is little cultivation and the human density on the land is very low. Consequently, erosion is not an important problem in this region.

The Guiana Highlands

This is a region of tame, geologically very old uplands, characterized by extensive tablelands, mesas, and scarps, particularly along the Brazilian border. The soils are derived from crystalline rocks and sandstone and are generally infertile. The vegetation is an intermixture of grass and semideciduous forest. The land is very sparsely settled and little cultivated. The region's remoteness from existing centers of population has been a deterrent to its more intensive utilization. Grazing is the most likely land use in the immediate future.

THE GUIANAS

British Guiana, Surinam, and French Guiana occupy a small area on the northeastern coast of South America astride the world heat-equator. From a narrow belt of mangrove marsh along the coast the tropical forest ex-

tends inland in all three territories covering both the coastal plain and the lower reaches of the Guiana highlands. It is estimated that three-fourths of the area of these European possessions is covered by virgin forest. Only in southwestern British Guiana and along several strips of poor sandy soil just inland from the coast is the dense forest displaced by a savanna type of vegetation. These areas of sandy soil are intensively cultivated and are apparently very susceptible to erosion. However, only 400 square miles out of a total area of over 170,000 square miles for the three territories is under cultivation, and it would therefore be wrong to speak of an erosion problem.

The inland areas that have been cleared of forest are either on level ground or have been placed under shifting cultivation in such a way that the land is given a long period of rest after an average of two years of cultivation. This practice is possible in the Guianas because of their low average population density.

It should be pointed out, however, that most of the soils in the Guianas are not naturally suited to permanent agriculture because of their poor structure and low organic content.

COLOMBIA

Colombia is so compartmentalized by alternating mountain ranges and deep, more or less parallel river valleys that, despite its ocean frontage on both the Pacific Ocean and the Caribbean Sea, it is one of the continent's least accessible countries. The Andes cross Colombia from south to north, leaving but a narrow coastal plain along the Pacific which is pinched out by several coastal ranges just south of the Panamanian border. Emerging from a jumble of ranges in the southern part of the country, the principal Andean chains thrust northward, separated from each other by the deeply entrenched valleys of the northward-flowing Cauca and Magdalena Rivers. The central chain, with numerous summits exceeding 10,000 feet, is the highest, but the eastern chain which contains several large intermountain basins (including the one in which Bogotá, the nation's capital, is located) is the most massive one and contains large areas of sharp local relief. Much of it is forested and some areas are only casually explored. This eastern chain in turn splits up into two ranges, one of which extends northeastward into Venezuela, the other northward to the Caribbean where it terminates in a mountain block called the Sierra Nevada de Santa Marta.

The eastern half of Colombia is a rolling plain, most of which lies at elevations of less than 1,000 feet above sea level. It is drained by the Orinoco and Amazon River systems.

Most of Colombia has a total annual rainfall that is adequate for all types of agriculture. However, there is a pronounced dry season between December and May in all but the eastern half of the country and the Pacific littoral. In the latter areas heavy rainfall occurs throughout the year. In the very high mountain districts total precipitation is moderate, but there is considerable cloudiness and condensation unrecorded by instruments. Only the lower western slopes of the Cauca and Magdalena River valleys suffer from inadequate rainfall and are locally semiarid.

Five general classes of soils may be distinguished in Colombia. On the high tablelands, above 9,000 feet, the soils are alpine, i.e., they are characterized by a high content of organic matter to a depth exceeding 3 feet in some places. These soils develop at elevations where condensation is responsible for a large portion of the available moisture. They are absorbent and generally moist. Potatoes and wheat are grown in many places, but little erosion results.

At the lower elevations, generally between 7,000 and 9,000 feet above sea level, the sub-alpine soils predominate. They are characterized by a dark-brown surface layer 1 to 2 feet thick overlying brown subsoils. Much of this area is in pasture but corn is also extensively grown in this zone. Erosion is severe in many places.

The next class of soils, found at somewhat lower elevations, is typical of the greater part of central Colombia. The surface soils are brown loams to clay loams less than 8 inches in thickness, and the subsoils are yellowish to reddish-brown clay loams or clays. They are used extensively for pasture but also include the principal areas of high-grade coffee production. They are readily erodible particularly where hard, impermeable layers are found near the surface. During periods of heavy rainfall they become easily saturated and slides are a common feature of the landscape. By long tradition, pastures are regularly burned over. This practice exposes the surface soil to the beating effect of rainfall and results in rapid runoff followed by sheet erosion.

On the plains of eastern Colombia the soils are old and thoroughly leached. They have all the characteristics of a kind termed *lateritic* by many investigators. The surface soils are light colored loams and the subsoils reddish-brown clays. All horizons are extremely acid. The vegetation of such areas is typically grass, with some gallery forests. Extensive grazing is the only economic activity, and erosion is localized in the vicinity of water holes.

The alluvial soils found in particular along the valley bottomlands are waterlogged, especially in the Caribbean lowlands along the lower course of the Magdalena River.

84° 82° 80° 78° 76° 74° 72° 70° 68° 66° 64° 62° 60° 58°

NICARAGUA

COSTA RICA

PANAMA

CURAÇAO (NETH.)

GOLFO DE VENEZUELA

LAGO DE MARACAIBO

TRINIDAD

VENEZUELA

BOLIVAR

BRITISH GUIANA

GEORGETOWN

VICHADA

COLOMBIA

AMAZONAS

GUAINIA

VAUPES

CAQUETA

PUTUMAYO

NARIÑO

CAUCA

HUILA

TOLIMA

CUNDINAMARCA

BOYACA

SANTANDER

NORTE DE SANTANDER

CESAR

MAGDALENA

LA GUAJIRA

ECUADOR

AMAZONAS

LORETO

SAN MARTIN

HUANUCO

JUNIN

ACRE

GUAPORÉ

PANDO

MADRE DE DIOS

VICHADA

COLOMBIA

AMAZONAS

GUAINIA

ECUADOR

AMAZONAS

LORETO

HUANUCO

ACRE

GUAPORÉ

PANDO

MADRE DE DIOS

B

B

B

B

B

B

84° 82° 80° 78° 76° 74° 72° 70° 68° 66° 64° 62° 60° 58°

LEGEND
REFERENCIAS
LEGENDA

A — Slight or no erosion.
Muy poca o ninguna erosión.
Pouca ou nenhuma erosão.

A/B — Dominantly slight erosion with 10% to 25% of eroded land moderately or severely eroded.
Predomina poca erosión; 10% al 25% de las tierras desgastadas están desgastadas moderadamente o en exceso.
Predominantemente pouca erosão com 10% a 25% de terreno corroído, moderadamente ou gravemente corroído.

B — Moderate erosion.
Erosión moderada.
Erosão moderada.

B/C — Moderate erosion with 10% to 25% of eroded land severely eroded.
Erosión moderada; 10% al 25% de las tierras desgastadas están desgastadas en exceso.
Erosão moderada com 10% a 25% de terreno corroído, gravemente corroído.

C — Severe erosion.
Excesiva erosión.
Erosão grave.

I — Land with soils undisturbed by man.
Tierras con capa vegetal virgen.
Terreno com solos em que o homen nunca tocou.

B/C — Moderate erosion with 10% to 25% of eroded land severely eroded.
Erosión moderada; 10% al 25% de las tierras desgastadas están desgastadas en exceso.
Erosão moderada com 10% a 25% de terreno corroído, gravemente corroído.

C — Severe erosion.
Excesiva erosión.
Erosão grave.

I — Land with soils undisturbed by man.
Tierras con capa vegetal virgen.
Terreno com solos em que o homen nunca tocou.

SURINAME
GUYANE FRANÇAISE
CAYENNE
PARA
RIO GRANDE DO NORTE
56° 54° 52° 50° 48° 46° 44° 42° 40° 38° 36° 34° 32°
12° 10° 8° 6° 4° 2° 0° 2° 4° 6° 8° 10° 12° 14° 16° 18°

They are intensively cultivated in the narrow flood plains along the upper Cauca River, but even in areas of high population density they are not subject to serious erosion.

From an areal point of view, grazing is undoubtedly the principal branch of agriculture in Colombia. While the country is the world's second-ranking coffee producer, this type of land use is purely local if compared to the large expanses of natural pastures. Erosion due to overgrazing is serious wherever the livestock population is too large for the relatively low carrying capacity of the range. This is the case in the mountain valleys and basins, rather than in the sparsely settled eastern plains. Erosion is locally significant in regions of specialized agriculture, such as the cacao and tobacco-growing district around Bucaramanga in the eastern range, and some of the coffee districts just east of the Cauca River valley. Coffee in Colombia is clean-cultivated, that is, the ground is scraped clean and all the weed growth is gathered in small mounds or windrows.

The lack of communication is one of the most serious drawbacks to the improvement of agriculture in Colombia; it inhibits the growth of a modern economy and hinders the spread of knowledge about soil conservation and farm management. Soil improvement depends upon the adoption of crop rotation and the cultivation of pastures. In areas of severe erosion special measures, such as contour farming and the use of diversion ditches, should be initiated together with rotation farming and the incorporation of organic matter into the soil. Many of the steeper slopes that are now in pasture should be reforested. Coffee plantations should not be cleaned so thoroughly. In other coffee-growing areas it has been found possible to control erosion and to improve soils by cutting the weeds 2 to 4 inches above the surface of the ground and allowing the trash to lie where it falls.

ECUADOR

A small country lying astride the equator, Ecuador offers as much physical diversity as its much larger neighbor to the north. Only 400 miles deep, Ecuador, nevertheless, embraces the three major land-form regions characteristic of all the countries of northwestern South America: a gently sloping coastal belt, the towering, steep-sided Andes which in this latitude are capped by extinct volcanic peaks, and a small portion of the vast, rainy-tropical Amazon basin.

Rainfall is high in the northern portion of the coastal plain and in the coastal hilly belt just south of the Colombian border, but decreases southward toward the Peruvian border. The slopes of the westernmost Andean ranges also receive a large amount of rainfall, but farther inland precipitation decreases markedly. The Amazon plain and the eastern wall of the Andes are already in the humid-tropical climatic region.

The coastal soils vary from brown clay loams in the more humid districts to very dark-gray neutral clays in the drier southern districts. The highland soils have a very dark-brown, highly organic surface layer reaching depths of 18 inches or more, underlain by brown or reddish-brown clay loam or clay subsoils. The soils of the Amazon basin are thoroughly leached and extremely acid, with grayish-brown loams to clay loams on the surface and reddish-brown clay subsoils.

Although the crude population density of the country is low, this ratio means little if it is realized that the total population is concentrated in a few clusters occupying but a small percentage of Ecuador's national territory. This is due in part to the country's physical configuration and in part to its history of settlement. More than half the population is composed of the descendants of pre-Colombian Indians who live in the intermountain basins of the Andes—the homeland of their ancestors—and engage in subsistence agriculture and stock raising.

Commercial agriculture is largely confined to the coastal plain where cacao is grown in many places. The soil in these plantations is so little disturbed by cultivation that there is no erosion. Even in the recently expanding banana districts of the coastal plain and in the few areas of shifting cultivation, erosion has not been severe.

Many localities in the Highlands show signs of moderate and severe erosion. This is particularly evident in the north where much of the land is used for sheep pasture. Here the soil is underlain by an impervious, cemented layer at a depth of about 3 feet. During periods of heavy rainfall sufficient moisture may be absorbed to supersaturate the soil which then becomes a semiliquid mass and, in places, literally flows with gravity, leaving the hardpan exposed. This mass movement is subject to some control where a species of *Agave* is planted as a fence. The roots of this plant appear to grip the hardpan and anchor the soil.

Just north of the capital, Quito, there is a semiarid district used extensively for sheep pasture; slopes are steep and erosion is generally serious. In the southern part of the country there is a region of steep, brushy, grazing land with thin soils in most places resting on shale. These are heavily overgrazed and there are extensive tracts which have been moderately eroded. The upper Amazon Valley is so sparsely settled that accelerated erosion is unknown.

Agricultural practices in the Highlands have changed but little under the influence of European settlement, except for the introduction of wheat and of sheep and cattle

raising. Locally, some attempts have been made to terrace the hillsides on which wheat is grown in the more densely populated intermountain basins. Many of these terraces are old and do not follow the contour precisely, but they appear to produce satisfactory results.

The opportunities for improving highland agriculture in Ecuador are great. Crop rotation that includes the production of fibrous-rooted plants and the incorporation of organic matter would surely contribute to increased yields and lessen the hazards of erosion. There is considerable danger of serious erosion occurring in the newly cleared lands of the intermountain basins where population growth is proceeding at a rapid rate. Most of these clearings are made on steep slopes and land management, including soil conservation practices, is not being applied.

A considerable portion of the western Andean piedmont is well suited to intensive tropical agriculture, particularly coffee growing. But the lack of roads in this area has prevented development. More intensive use could also be made of the coastal regions, but this would involve the resettlement in a humid tropical climate of large numbers of people who for centuries have lived in the Highlands and have adapted their way of life to the physical environment of the Andes.

PERU

Peru, like Colombia and Ecuador, is a land of contrasting landscapes. It has a Pacific coastline 1,400 miles long that extends from a few hundred miles below the equator southeastward to 18° S; it straddles the massive heights of the central Andes and, in the east, it extends into the humid-tropical Amazon lowlands.

The Coastal Belt

Peru's coastal belt, 10 to 40 miles wide, is not a uniform plain. There are several lowlands, (the largest one in the north) separated from each other by a narrow coastal range which widens toward the south of the country. The climate of the region is arid with precipitation highly irregular.

The coastal belt is traversed by 50-odd short, snow-fed Andean streams which reach the coast at right angles, cutting narrow defiles through the coastal range. At the point where these streams issue from their V-shaped Andean valleys, forming alluvial fans upon the piedmont, their waters have been diverted for irrigation and several oases have come into existence. Here long-fiber cotton, sugar cane, and rice are intensively cultivated. About one-third of the country's population, including its largest cities, is found along these coastal streams or at their mouths on the Pacific Ocean. The seaward-facing slopes of the coastal range are seasonally covered by semiarid grasses, thanks to the moisture supplied by dense fog banks overhanging the zone of contact between water and land. They support a light grazing economy.

Erosion in the coastal belt as a whole is striking, but practically everywhere it is due to natural causes—geologic rather than accelerated erosion. The occasional torrential downpours in this thoroughly arid region have etched out a fantastic pattern of gullies and canyons. In the previously mentioned agricultural oases, improper irrigation practices have, at times, caused the surface soil to be removed from one area and deposited elsewhere with deleterious effects. However, total damage has been slight.

The Highland Zone

The Andes have a very complex and diversified structure in their Peruvian segment. The individual ranges are separated by longitudinal troughs which impede transverse communication and isolate the Highland population clusters from one another.

Subsistence agriculture is the principal form of land use in the high Andes. The Indian population has shown almost total indifference to western techniques. An amazingly high level of agricultural development had been achieved under Inca rule—as revealed by scores of well-preserved terraces which had been carved into the steep mountainsides—but with the destruction of the Inca Empire the population has reverted to a more primitive system of cultivation. Moderate erosion may be observed throughout the inhabited part of the Highlands. In places the slopes have been so badly washed as to expose the bedrock and some areas have been so thoroughly gullied as to render the land permanently unsuited to agriculture. Overgrazing by sheep, llamas, and alpacas has also resulted in surface wash and gullies. No soil conservation measures have as yet been introduced in the Highlands, and the yields of subsistence crops (potatoes, grain, corn) are very low.

The Eastern Slope and Lowlands

This vast region, which constitutes about half of the total area of Peru, is settled only sparsely and in isolated clusters. Huanuco is the center of population on the eastern slope of the Andes and cultivation is limited to the narrow alluvial basin in which the town is situated. Toward the north and east, in the direction of Tingo María, some of the hillsides are under shifting cultivation. In the isolated areas of sedentary agriculture, such as in the vicinity of San Martín, sheet erosion may be observed as a result of heavy rainfall on permanent clearings.

There is very little agriculture in the Peruvian portion

of the Amazon basin. Cultivation is limited to the river banks, the fields being several miles long and only a few feet wide. These strips are under water for several months every year, and the crops (field peas and rice) are planted directly in the fresh river deposits upon the retreat of the flood. There is neither geological nor accelerated erosion in this rain-forest lowland with little more than a primitive gathering economy.

BOLIVIA

Situated near the center of South America where the mountain backbone reaches its greatest width, Bolivia is generally considered to be a republic of the Andes and little attention is paid to the fact that half its area is a lowland, partly in the Amazon basin and partly in the Chaco plain.

The southeastern part of the country consists of the *altiplano*, a vast, almost barren high plateau with an exceedingly level surface dotted with half-dry beds of old salt lakes. The eastern flank of the Andes runs in a NW-SE direction in a belt 100-150 miles wide. This is a region of old sedimentary rocks which have been severely folded and dissected to form rugged mountains. Some volcanic materials are also in evidence. A considerable part of this belt is nearly barren of vegetation, but the northeastern slope facing the Amazon plain and receiving high rainfall is heavly wooded. The eastern lowlands have a vegetation ranging from dense tropical jungle in the north to a savanna type of prairie in the south. Extensive tracts in the lowlands, especially along the major streams, are marshy and inaccessible or seasonally flooded.

The soils of the *altiplano* range from sandy loams to clays and are brown or reddish-brown in color. The Andean ranges along the edges of the *altiplano* are for the most part bare or snow-covered but in a few places (east of Oruro, for example), a thin brown sandy loam to loam soil with a sandy subsoil has developed. In the lowlands soil with a clay loam subsoil has developed. In the lowlands of eastern Bolivia the soils consist of thoroughly leached acid loams to silty clay loams with reddish-brown clay subsoils. Large areas are poorly drained. Others, for example the district surrounding Santa Cruz, have been covered with more recent alluvial deposits and on them a soil suitable for agriculture has been developed.

Most of Bolivia's agricultural population is concentrated on the *altiplano* at elevations of 12,000 feet and higher. It is engaged in growing *quinoa*, wheat, and potatoes, and in pasturing sheep. No attempts have been made here to conserve the soil and serious local erosion has been the result. Wind erosion is an important hazard in many places. In the steeper country east of Oruro nomadic sheep grazing has also caused severe soil erosion.

Bolivia's commercial agriculture is primarily concentrated in a limited number of intermountain valleys, such as that of Cochabamba. Intensive cultivation depends on irrigation, for the rainfall is scanty. Erosion is not a problem in these valleys except where the adjacent mountainsides are used for pastures.

No systematic measures to control soil erosion have so far been introduced in Bolivia, but a broad program is now being initiated under a technical assistance program. A great deal of work will be required to establish a viable system of agriculture on the *altiplano* with its poorly managed pastures. In eastern Bolivia a project is under way to reclaim and settle the region of Santa Cruz. A careful management program will have to be devised in this area to prevent the sandy soils from blowing once the land is placed in cultivation. In the streets of Santa Cruz, for example, small sand dunes accumulate at intersections, often impeding automobile traffic.

CHILE

A long and narrow strip of land stretching some 2,600 miles over almost 40° of latitude, Chile has a diversity of climate and topography ranging from an arid-tropical coastal desert in the north to a rain-drenched subarctic taiga in the extreme south. The long coastline is paralleled by hills in the north and center and embayed by fiords in the south; there is no true coastal plain. In fact, hills and mountains are the dominant feature of the landscape, with the country's eastern border (nowhere more than 250 miles from the sea) formed by the Andean wall rising steeply to elevations of 23,000 feet.

Agricultural activity is concentrated in the central region of Chile which has often been compared to the central valley of California. While the comparison holds for the climate—both areas having a Mediterranean climate—it does not for the topography because Chile's central valley is not so level as that of California. Yet it has almost 90 per cent of the country's population and a highly diversified system of agriculture. Much of the valley is irrigated and produces high yields despite the long, dry summers.

Endowed with a favorable physical environment, abundant natural resources, and an active population, Chile has not been too severely affected by accelerated erosion. The following discussion of soil erosion in Chile is presented in latitudinal sections, each of which embraces the full width of the country, beginning with the northernmost arid zone.[1]

[1]The discussion of soil erosion in Chile was prepared by Ing. Manuel Rodriguez Zapata, Jefe Sección Conservación de Suelos, Departamento de Investigaciones Agrícolas, Ministerio de Agricultura, Santiago, Chile.

(*Continued on page 223*)

Welcome to the Southeast

Beautiful Hemming Park in the center of downtown metropolitan Jacksonville keeps the Florida atmosphere of the tropics alive in the thriving commercial and industrial heart of Florida.

Members of the Soil Conservation Society of America traveling through the southeast enroute to the Ninth Annual Meeting in Jacksonville, Florida, will be impressed with the greenclad fields, extensive terraces and strip crops fitted to the contour of the land; also the many sparkling ponds which provide water facilities and recreation for farm people. Fields that were once bare and badly eroded are now grazing high grade cattle on excellent pastures — an indication of the change from row crops to grass.

These developments, and others like them, illustrate the great advances which have been made by soil conservation district cooperators and other farmers in adapting to their own use the results of scientific research and investigation — all based on the wise and efficient use of our land and water resources.

Left. Pensacola Bahia grass represents one of several grasses which withstood the 1952 drought. *Right.* Along with the phenomenal development of pastures in Florida has come the introduction of improved breeds of cattle, principally Brahama cattle.

Ninth Annual Meeting

Soil Conservation Society of America

George Washington Hotel, Jacksonville, Fla., November 15--17, 1954

(Preliminary Program)

Sunday November 14

1:00 p.m. **Registration** *for SCSA Members, Headquarters Hotel.*

Monday November 15

10:00 a.m. **Opening Session** — COLIN D. GUNN, *State Conservationist, Soil Conservation Service, Gainesville, Florida, presiding.*
President's Message — R. Y. BAILEY, *Auburn, Alabama.*
Keynote Address — *"The Land—The Source of Our Strength,"* GOVERNOR HERBERT E. TALMADGE *of Georgia.*

12:30 p.m. **Tour of Cary Forests and of the Clark Ranch.** *This tour is free to all registering for the meeting including the ladies.*

5:30 p.m. **Free Barbecue**—*Courtesy Nassau County Soil Conservation District.*

8:30 p.m. **Conservation films** — *George Washington Hotel.*

Tuesday November 16

9:00 a.m. **General Session** — DR. RICHARD E. MCARDLE, *Chief, U. S. Forest Service, Washington, D. C., presiding.*
Forest Protection and Timber Production in Relation to Soil and Water Conservation — E. P. CLIFF, *Assistant Chief, U. S. Forest Service, Washington, D. C.*
Importance of Woodland Resources in Economy of Southeast—H. J. MALSBURGER, *General Manager, Southern Pulpwood Conservation Association, Atlanta, Georgia.*
Wildlife Problems in Draining Wet Lands in Southeast — WALTER GRESH, *Southeastern Director, Fish and Wildlife Service, Atlanta, Georgia.*
The Effects of Organic Matter on Soil Aggregation, Permeability and Runoff — *(To Be Filled).*

1:30 p.m. **General Session** — D. A. WILLIAMS, *Administrator, Soil Conservation Service, Washington, D. C., presiding.*
Developments in the Small Watershed Approach to Flood Prevention and Conservation — CARL B. BROWN, *Director, Planning Division, Soil Conservation Service, Washington, D. C.*
Humid Area Irrigation Growth—Problems—Benefits — T. H. QUACKENBUSH, *Irrigation Engineer, Soil Conservation Service, Washington, D. C.*
Water Resource Management—Competition for Available Supplies and Need for Water Rights Legislation — CLAIR P. GUESS, *Executive Secretary, Soil Conservation Committee of South Carolina.*
Water Resource Management—State and Local Responsibility for Solving Water Rights Problems — SAM A. THOMPSON, *Chairman, Mississippi Inter-Organizational Committee on Water Resources.*

7:00 p.m. **Banquet**
Honor Ceremonies and Awards.
Address: Educational Needs for an Effective Program of Conservation — SHELBY M. JACKSON, *State Superintendent of Education, Baton Rouge, Louisiana.*

Wednesday November 17

9:00 a.m. **General Session** — DR. H. G. SPRAGUE, *Head of Agronomy Department, Pennsylvania State College, State College, Pa., presiding.*
A Review of the Economic Effects Experienced in Conservation Farming — RUSSELL O. OLSON, *Agricultural Economist, Ohio State University, Columbus, Ohio.*
Conservation of Diverted Acres to Meet Continuing National Needs — CLAY H. STACKHOUSE, *Assistant Deputy Administrator for Production Adjustment, Commodity Stabilization Service, Washington, D. C.*
Grassland Agriculture in the Old Cottonbelt — DR. T. S. BUIE, *State Conservationist, Soil Conservation Service, Columbia, S. C.*

12:00 **Luncheon** — E. H. GRAHAM, *Vice-President, Soil Conservation Society of America, presiding.*
Business of the Society—*Reports of officers—committees—resolutions.*

2:00 p.m. **General Session** — WALLACE H. MITCHELLTREE, *Extension Soil Conservationist, Rutgers University, New Brunswick, N. J., presiding.*
Landlord Tenant Cooperation in Preparing Conservation Plans — J. J. WALLACE, *Professor Agricultural Economics, Iowa State College, Ames, Iowa.*
Landlord-Tenant Relationships — S. S. HUDSON, *Principal Economist, Canada Department of Agriculture, Ottawa, Canada.*
(Open discussion will follow the above papers.)
The National Conservation Good Turn Program — Boy Scouts of America — DR. ELMAAR A. BAKKEN, *National Director, Rural Scouting, New York, N. Y.*
Important Findings of Technical Committees — WALLACE MITCHELTREE, *Session Chairman.*

NOTE: *Other highlights include special events for the ladies.*

GRASSLAND PROGRAM

Jacksonville, Florida, November 13-14

Sponsored by Joint Committee on Grassland Farming and the Soil Conservation Society of America

Saturday, November 13

Arrangements: Bus tour of forage programs on farms in vicinity of Jacksonville. Buses will leave from Hotel George Washington and return thereto. Advance reservations to insure adequate bus space should be made with Frank Winchell, Jacksonville Tourist and Convention Bureau, 307 Hogan Street, Jacksonville 2, Florida. Hotel reservations, Nov. 12 to Nov. 14 inclusive, should be made directly with the Hotel George Washington, Jacksonville, Florida.

Morning Tour: Visit Gustafson Dairy near Green Cove Springs. This is one of the largest privately owned dairies in Florida, with 1200 milking cows. Inspection of forage program, which includes a complete water control program with 1000 acres of subirrigation established. Forage plants used on irrigated land include Pensacola Bahia, white clover, domestic ryegrass, and carpet grass. Also, a considerable acreage of class IVs soils has been improved with Pensacola Bahia grass.

Afternoon Tour: Visit Dr. Hayes' 500 acre beef ranch 15 miles west of Jacksonville. This ranch is on "W" type grasslands and is drained with a combination of canals and W-ditches. Grasslands are occupied by coastal bermuda, Rhodes grass, Argentine and Pensacola Bahia, and white clovers. There is also a project for fattening steers which utilizes fresh clovers cut daily with a forage harvester and hauled to the feed lot.

Sunday, November 14

Speaking Program at Hotel George Washington
(Open to the public)

Grassland Farming in the Cotton South

Morning Session

1. **Day Length and Crop Production.** H. A. BORTHWICK, *U. S. Department of Agriculture, Beltsville, Maryland.*
2. **Potentialities of Coastal Plain Grasslands with Heavy Fertilization.** G. W. BURTON, *Georgia Coastal Plain Experiment Station and University of Georgia, Tifton, Georgia.*
3. **Lessons from Pasture Studies in Florida, Iowa and Kansas.** GORDON B. KILLINGER, *University of Florida, Gainesville, Florida.*
4. **Trace Elements in Animal Nutrition in Florida.** G. K. DAVIS, *University of Florida, Gainesville, Florida.*

Afternoon Session

5. **Year-Round Forage Program for Georgia.** B. H. HENDRICKSON, *Soil Conservation Service, Watkinsville, Georgia.*
6. **The Range Cattle Industry in Florida.** W. G. KIRK, *University of Florida Experiment Station, Ona, Florida.*
7. **The Dairy Industry of the South.** HERMAN BOYD, *President, Florida Dairy Association, Hall & Boyd Dairy Farm, Inc., Route 1, Box 1188, Miami 4, Florida.*
8. **The Future of Beef Cattle Industry in the South.** IRLO BRONSON, *Kissimmee, Florida. Formerly President, Florida Cattlemen's Association, State Senator, and Cattle Rancher.*

MAKE YOUR HOTEL RESERVATION TODAY!

Ninth Annual Meeting—SCSA

Jacksonville, Florida, November 15-17, 1954

Members and friends planning to attend the Ninth Annual Meeting of the SCSA should make their hotel reservations as soon as possible. This also applies to the annual meeting of the Joint Committee on Grassland Farming—November 13-14. The George Washington Hotel will be the headquarters for both meetings.

All reservations should be made directly with the headquarters hotel. Those that cannot be accommodated by the hotel will be sent to the Jacksonville Tourist and Convention Bureau for assignment to hotels located within two blocks of the George Washington.

Mr. Frank Winchell, Manager of the Tourist and Convention Bureau will gladly assist members desiring information about extended trips in Florida and other southern states. Inquiries should be addressed to Mr. Winchell at 307 Hogan Street Jacksonville.

The following hotels and rates are listed for your information:

	HOTELS — All within two blocks of headquarters			
Type of accommodation	George Washington Headquarters	Mayflower	Roosevelt	Seminole
Single — 1 person	4.50— 5.00 6.00— 7.00	4.00— 5.00 6.00	4.50 & up	4.50— 5.00 6.00— 7.00
Double Bed — 2 persons	7.00—12.00	7.00—10.00	7.50 & up	7.00—10.00
Twin Beds — 2 persons	9.00—10.00 12.00—14.00	8.00—12.00	8.50 & up	8.00—12.00
3 Beds — 3 persons	11.00—12.00 14.00—16.00	9.00—13.00	10.50 & up	9.00—13.00
4 Beds — 4 persons	13.00—14.00 16.00—18.00	10.00—14.00	12.00 & up	10.00—14.00
*Two room suites— 2 persons	18.00—22.00 35.00	———	18.00—22.00 25.00	———

*A slightly higher rate will be made if 3 or 4 persons use a suite. Individuals desiring motel accommodations in Jacksonville or on the beach (20 miles) should contact Mr. Winchell.

Tear out and Mail - - - - -

THE GEORGE WASHINGTON HOTEL*
Attn: Reservation Manager
Jacksonville 2, Florida

Dear Sir:

I plan to attend the Ninth Annual Meeting of the Soil Conservation Society of America and the Joint Committee on Grassland Farming. Please make the following reservations and send me confirmation:

Names of Occupants	Type Room Desired	Rate	Date & Time of Arrival

Mail confirmation to:

Address:

City:

*In the event you are filled my choice of hotels would be:

Second Choice..... Third Choice .....

(*Continued from page* 219)

From Parallel 18° to 30° S

This section includes most of Chile's coastal desert as well as a portion of the high tableland (*altiplano*) which extends across the border into Bolivia and Argentina.

The Northern Desert: Situated in the lee of the cold offshore Humboldt Current, this arid coastal belt receives almost no rainfall—a maximum of 4 inches per year with pronounced annual fluctuations. Only irrigated agriculture is feasible, and even that is on a very small scale because of the high cost of piping water overland from the Andes.

High Mountains and High Plateau: The rainfall is higher than in the coastal desert (8-12 inches annually above the elevation of 6,000 feet), and it is concentrated in the summer months in contrast to the rainfall distribution in the southern part of the country. Except for a few small oases in the vicinity of mining camps, there is no agriculture on the plateau. Herds of llamas graze the natural pastures. Erosion is mostly geological with grazing responsible for only minor acceleration.

The agricultural land in this region is concentrated in the narrow, deeply incised alluvial valleys below the upland surface. A variety of subtropical crops (alfalfa, olives, cotton, sugar cane) is grown there, in part, under irrigation.

From Parallel 30° to 33° 30′ S

This typical steppe country (the true desert ends at 30° S) with an annual rainfall ranging from 5 to 25 inches, except in the high Andes where it reaches 50 inches. The climate is of the Mediterranean type—winter rainfall and a long, dry summer. Along the Pacific coast there are small areas of level to undulating land on marine terraces, with fertile, deep soils which are susceptible to erosion. Wheat growing follows a summer-fallow period. Winter legumes and potatoes do well during the mild rainy season. Erosion is active on these terraces and deep gullies form easily in sandy soils. The over-all classification is *moderate*.

On the rolling and hilly lands of this same region dry-farming is common—summer fallow is followed by wheat, and sheep are grazed on annual grasses. The soil, overlying weathered granodiorite rocks for the most part, is very susceptible to erosion. Numerous gullies are found in the area and severe erosion occurs locally.

Several alluvial valleys have cut a path through the coastal hills. Here tree crops, alfalfa, small grains, and vegetables are grown intensively under irrigation. There are minor occurrences of erosion as a result of improper irrigation practices and a slight local salinity problem.

From Parallel 33° 30′ to 37° S

This includes the northern part of the central valley of Chile, the most productive agricultural area, with 2½ million acres of irrigated land. The valley is bounded on the east by the foothills of the Andes and on the west by the coastal range, which is a center of dry farming. The principal crops grown on the valley's irrigated alluvial soils are alfalfa, red clover, small grains, fruits and vegetables. There is little or no erosion.

In the Andean piedmont some slight to moderate erosion has occurred, particularly on the steeper lands that have been placed under intensive cultivation. The better soils are young—formed on alluvial fans or on wind-blown volcanic ash. They are used for grain production and cattle pastures.

From Parallel 37° to 42° S

In this region irrigation is not so important because of higher annual rainfall more evenly distributed over the seasons. However, farmers must reckon with a short summer drought. The natural vegetative cover is more abundant; pastures and forests take the place of shrubs and short grasses. In general, therefore, erosion is a lesser hazard in this latitude belt than in the region to the north.

The southern part of the central valley produces wheat, oats, potatoes, and livestock. Most of the soils are formed from volcanic ash overlying old glacial till. There is little erosion.

Slight to moderate erosion is shown for the Andean piedmont and the coastal ranges in this latitude. Severe erosion is only a local occurrence where wheat is grown on steep slopes and on less permeable nonvolcanic soils.

From Parallel 42° to 56° S

The region's coastal belt resembles the panhandle of southern Alaska. It is Chile's fiord country. Rainfall is very heavy and the steep slopes are densely clad with evergreen forests. Islands, the remnants of a submerged mountain range, dot the offshore waters. Agriculture is limited to the eastern portion of the Island of Chiloé, where potatoes are grown on highly permeable loessial soils that do not erode easily, and to some recently settled interior valleys. In general, the lush vegetative cover has protected the soil from removal by runoff. Only in a few localized areas have forest fires and the clearing of steep slopes taken a toll of the surface soil's thick mantle of organic matter.

East of the main Andean range, which in this latitude is not so high as farther to the north, Chile possesses a narrow strip of semiarid steppe land adjacent to Argentina's Patagonia. The soils in this district are subject to wind erosion especially where the natural pasture has been overgrazed by sheep.

ARGENTINA

Argentina is the only part of Latin America with a large area of arable lowland—at least 250,000 square miles—situated within the temperate zone. This is the famed Pampa in which most of the country's agricultural wealth and one-half its population are concentrated. It is by far the most important of Argentina's geographic divisions and erosion control has long been a matter of primary concern in this black-soil region of great natural fertility. The other regions of Argentina surround the Pampa and are economically and culturally its satellites. They are (1) the oases and mountains of the west, (2) the Patagonian tableland which occupies the attenuated southern part of the country, (3) Mesopotamia, the northern districts, between the Paraná-Paraguay and Uruguay Rivers, and (4) the Chaco, the "empty quarter" of northern Argentina.

The Pampa

The Pampa, the great plain of Argentina, is a homogeneous physiographic unit situated to the east of the Andean piedmont and to the south of the Chaco. It also forms a rather clearly defined geologic region consisting of a deep accumulation of unconsolidated waterlaid and windlaid material resting on a hilly surface of granite and other ancient crystalline rock. Although the entire area lies within the warm-temperate belt with its typically variable weather due to the passage of cyclones, there is a wide variation in rainfall from west to east with corresponding changes in vegetation, soils and land use. Hence one often speaks of two pampas, the semiarid or subhumid Pampa in the west, comparable to the drier portion of the Great Plains of the United States, and the humid Pampa in the great land bulge south of Buenos Aires, whose climate and intensity of land use resemble that of the prairies. The natural vegetation of the west was low grass and low scrubby trees, whereas the humid eastern Pampa was predominantly in tall grass.

The Pampa contains over 80 per cent of Argentina's cultivated land in an area extending some 70 miles north-south between 30° and 40° S latitude and westward to a line (16-inch isohyet) where annual rainfall becomes insufficient even for wheat growing. Regional unity is based essentially upon a similarity of human activity throughout the area. It is a region in which the basic economic activity is commercial agriculture in the form of either grain farming or livestock ranching. Slightly over one quarter of all the cropland in the Pampa is occupied by wheat which in total acreage is rivaled only by alfalfa. Another quarter of the cultivated land is devoted to flax and corn, and 10 per cent of the land is in oats, barley, and rye.

Although these grains are widely produced through the Pampa, a striking pattern of specialization has developed over the years. The moist and warm conditions along the northern edge of the Pampa are favorable to corn and flax; the cooler and drier climate responsible for the lighter soil of the central Pampa favors wheat and alfalfa, while barley, oats, and rye are best adapted to the colder winters and shorter growing season in the south.

The chief wheat area forms a giant crescent along the western margin of the humid Pampa, having been confined to this area by climate, soil, and drainage conditions. Towards the north the summers are too wet and the winters too dry. Westward expansion is handicapped by insufficient precipitation. And wheat growing has not spread into the eastern part of the Pampa where the land is low, poorly drained, and has a heavy clay soil.

Wind erosion has long been a major threat to the Pampa, as it has been to the Great Plains of the U. S. Thus the map of soil erosion in Argentina shows a large area more or less co-extensive with the wheat crescent as being moderately eroded, with 10-25 per cent of the land severely eroded. In this transition zone between the arid and the humid Pampa the wind picks up the fine loess and carries it eastward. This natural process (geological erosion and deposition) is responsible for the great fertility of the entire region. However, the process has been accelerated by cultivation and particularly so in recent years as a result of government subsidization of wheat growing in the marginal rainfall districts of the semiarid Pampa.

The Oases and Mountains of the West

The oases of western Argentina are relatively insignificant in size but have achieved outstanding importance in the economy of the country because of their great productive capacity. Owing to the fact that they are located in a belt extending over some 15° of latitude along the Andean piedmont, there is a considerable variety in the products grown in these oases. Sugar cane is the chief crop in the north, wine in the south, wine and alfalfa in the central oases. The intensive cultivation of sugar cane in the large oasis surrounding the city of Tucumán has attracted a large population which in turn has created an erosion hazard especially along the dry margins of the irrigated district.

The arid piedmont and mountains of western Argentina are very sparsely populated outside of the oases. Xerophytic vegetation is characteristic throughout the region. Annual precipitation is low, with the southern third of the region receiving less than 10 inches per year. Agricultural activity is limited to grazing. Goats and wool sheep are the only animals capable of subsisting on the meager pastures and the available water. Overgrazing

has caused some soil erosion, but much less than in equally arid Patagonia to the south, where wind velocity is considerably higher.

Patagonia

Patagonia is the name given to the portion of Argentina lying south of 39° S latitude. In marked contrast to the rest of the country, this region of 300,000 square miles has an unfavorable man-climate. It has cold, stormy winters, cool summers (especially in the south) and frequent fogs. Except in the western mountains, rainfall is inadequate for agriculture and the stony plateau has only a scant vegetal cover of bunch grass and scrub. Wind erosion—a geological agent in this barren region—would be a much more serious hazard were it not for Patagonia's low population density. Sheep raising is the chief activity but it is a very extensive type of grazing. So thin is the pasturage that ten times as much area must be allowed for each head than in the Pampa. Cultivated crops are limited to irrigated strips along the valley floors of the several rivers which flow eastward across the full width of the Patagonian tableland.

Mesopotamia

Between the two major southward flowing rivers of Argentina—the Paraná-Paraguay and the Uruguay—lies a belt of Argentine territory consisting of forested alluvial tracts along the streams and of nearly level to rolling interstream divides of open grassland. The northernmost section of this panhandle is flanked by Brazil on the east and by Paraguay on the west. Here the soils formed over massive extrusive rock formations are predominantly brownish-red, friable and permeable. Araucaria forest is the region's natural vegetation. This is the only part of Argentina with a subtropical climate, its rainfall varying from 50 to 60 inches per annum. *Yerba maté*, rye, manioc, cotton, and corn are the principal crops. Erosion is not a major problem except in the neighborhood of population centers where livestock is grazed intensively and along the steeper divides where some row crops are not grown along the contour.

The Chaco

Although some specialized agricultural development is taking place along its southern margins, the 150,000 square miles that make up the Chaco are the least developed of the lowlands of Argentina. The climate of the area is one of its greatest handicaps. Summers are hot and humid with precipitation concentrated in that season. Heavy rainfall combined with low relief produces extensive seasonal swamps. Winters are so arid that supplies of fresh water are frequently inadequate for agriculture and the streams coming down from the Andes are for the most part intermittent. Only two rivers traverse the entire width of the Chaco, but much of the area drained by them is swampy and seasonally flooded. The *quebracho* tree and cotton, the latter a relatively new product in this region, provide the leading cash products. Livestock raising plays a minor role in the economy. Crop agriculture outside of the cotton area is limited to subsistence farming which is carried on so sparsely and on such level land that erosion has not been a major consideration.

URUGUAY

Uruguay is the smallest and one of the least diversified of the South American republics, primarily because of its uniform topography. It is a land of plains, in which differences in relief remain within a range of 2,000 feet. The southeastern coastal belt and the southwestern part of the country along the shores of the Río de la Plata are lowlands of alluvial or marine origin. A belt of hills trends northeast-southwest through the central part of the country, and northwestern Uruguay encompasses the southernmost spur of Brazil's Paraná plateau, a tableland underlain by massive basalt formations. Over much of the country slopes of 3 to 8 per cent are considered rough topography. These "steep" areas are not cultivated because they are mostly very stony and because level arable land is still plentiful. Thus, Uruguay is in the fortunate position of not being confronted by the soil erosion problem so common to such a large part of Latin America, namely the loss of topsoil as a result of the clean cultivation of sloping lands.

The soils of Uruguay that are presently under cultivation are of medium to poor fertility. Loess deposits, 25 feet or more in thickness, cover portions of the south and southwest of the country, thinning out in an eastward direction. These deposits consist of very fine volcanic dust and are poor in iron, calcium, and phosphate. They are somewhat susceptible to erosion wherever they have dense subsoils and are underlain by a basement complex of granite and gneiss. The extensive crystalline rocks which underlie the northwestern part of the country have been thoroughly weathered and, under the prevailing climatic conditions, have formed a shallow, almost black clay soil that is rich in calcium and phosphate and is only slightly susceptible to erosion.

Uruguay has a humid subtropical climate with cool summers and no pronounced dry season. Total annual rainfall, about 40 inches, is nearly uniform throughout the country. Average records are often misleading, however. An examination of climatic records over the years reveals significant seasonal differences in precipitation as well as the frequent occurrence of heavy downpours of

great intensity. The record also shows that periods of prolonged drought occur at irregular annual intervals, averaging about three years out of ten. During the winter and spring rains, when evaporation rates are low, surface soils are rapidly saturated because of slow infiltration and considerable surface runoff occurs.

Only about 8 per cent of Uruguay's arable land is under cultivation. Wheat, corn, sunflowers, and flax are the chief crops, the rest of the land is devoted to livestock raising. Erosion hazards are limited to this small percentage of the total area, and particularly to the land on which wheat and flax are grown. These two crops require a well-prepared seed bed, and the timing of this preparation coincides with the part of the year in which a high rate of runoff is likely to occur. Over the years some sheet erosion has resulted from overintensive cultivation of certain areas. These are the districts just north and northeast of Montevideo which have had the longest history of cultivation and in which half the country's population is concentrated.

Wind erosion is only a minor factor in Uruguay. It is limited to the narrow belt of sand dunes along the coast and to patches of sandy soil in the northern part of the country where peanuts have been planted. Reforestation, particularly the planting of eucalyptus trees, could prove an effective erosion control measure as well as a commercially profitable venture in view of Uruguay's lumber shortage.

Despite the overwhelming importance of livestock raising in Uruguay's economy, overgrazing is not a major cause of erosion. However, the recent findings of a World Bank Mission to Uruguay will be of interest:[2]

1. The watering places are too scattered and are, therefore, used by too large a number of livestock, with a consequent danger of soil-loosening through trampling.
2. The number of sheep has increased in recent years to a point where it exceeds the carrying capacity of the marginal range.

The Outlook for Soil Conservation

In 1944 a Soil Classification and Conservation Service was established as a division of the Ministry of Agriculture and Livestock. However, little has been accomplished by this unit in the intervening ten years because of a shortage of funds and of trained personnel, and the lack of an aerial photocoverage needed for a soil survey. As in so many other Latin American countries, primary emphasis has been placed on the construction of terraces to control erosion. In the opinion of the agricultural expert on the Mission, other aspects of land management would require more immediate attention. These include an inventory of erosion-damaged lands, a detailed analysis of the physical factors conducive to erosion, and an investigation into the economics of farm ownership, agricultural credit, and land-use methods.

Uruguay is beginning to understand that it is cheaper to prevent erosion than to restore damaged lands. The currently planned conversion of marginal wheat and flax fields to grazing land is a first step in the right direction.

PARAGUAY

Paraguay has one outstanding feature favorable to its future well-being: it is an agricultural country with a potential food production beyond the needs of its present population. With a favorable climate and many thousands of acres of good and responsive soils, there is no need for either privation or harmful exploitation of the land.

As in many other Latin American countries, however, the people are concentrated in a relatively small area in the central portion of the country just east and southeast of Asunción. About 75 per cent of the Republic's inhabitants live within a hundred-mile radius of Asunción.

The lands of Paraguay are undulating to gently rolling; the parent material of the soils is derived from crystalline rocks for the most part and from sedimentary formations locally. Annual rainfall is 60 to 70 inches with a moderate dry season during the three winter months. In the rainy season heavy showers are common. The chief crops are corn, manioc, cotton, sugar cane, and peanuts.

Soil erosion occurs in Paraguay chiefly in the central part of the country. Clean cultivation of sloping land during the season of heavy showers results in moderate to serious soil losses. However, the deeper soils developed from basalt are not only resistant to erosion, but are of such a composition that they are readily reclaimed if erosion is only slight or moderate. Soils formed over granites and sandstones are more subject to erosion and more difficult to restore to productivity once eroded.

Paraguay is indeed fortunate in that it has the means to solve its erosion problems. The country possesses large areas of undeveloped, arable land of good quality upon which settlement by immigrants, as well as by internal migrants from the overpopulated districts surrounding Asunción, is not only feasible but desirable.

About one-half of eastern Paraguay, i.e., that part of the country east of the Paraguay River, is in virgin hardwood forest. Most of this eastern section is an elevated

[2] *The Agricultural Development of Uruguay.* Report of a Mission sponsored by the International Bank for Reconstruction and Development and the Food and Agriculture Organization at the the request of the Government of Uruguay, 1951.

plateau rising as high as 2,000 feet. This region is underlain by alternating dark-colored lava beds and red sandstone layers.

Western Paraguay is known as the Chaco. This is a vast level plain subject to extensive annual flooding. It is covered with grass, scattered clumps of palm trees and some scrub forest. This region of over 150,000 square miles contains but 5 per cent of the country's total population; hence it has a very low population density. Economic activity is restricted to extensive cattle raising and to the extracting of *quebracho* from the tree of the same name.

BRAZIL

Brazil is a continent within a continent. Not only does it occupy an area substantially larger than that of continental United States, border all but two of the countries of South America (Chile and Ecuador), and extend from a point 5° north of the equator to 34° south, but within its territory it also reveals great variations in climate, topography, soil, vegetation, types of farming, population density and consequent occupancy of the land. Hence it is necessary, in our consideration of soil erosion problems, to divide this huge and diverse country into regions of comparable erosion-producing conditions.

South Brazil

This area includes that portion of Brazil that extends south from approximately the Tropic of Capricorn—23.5° S; it includes the States of Rio Grande do Sul, Santa Catarina, and Paraná with the exception of the coffee zone in the north of Paraná.

This area has an average annual rainfall of 60 inches rather evenly distributed over the year. Furthermore, the climate does not favor coffee, because of the danger of frost, nor cotton because of the year-round distribution of rainfall. Thus erosion problems that arise wherever these two crops are grown in other parts of Brazil are of little concern here.

The soil erosion problems of southern Brazil may be characterized as those that arise in connection with wheat cultivation and to a lesser extent with the growing of corn on sloping lands. This does not mean that all of south Brazil is planted in these crops. As a matter of fact, most of the territory of Rio Grande do Sul is natural grassland used for extensive grazing. And both Santa Catarina and Paraná still have large areas of unused land, especially in the west, drained by tributaries of the Paraná River. Thus, the areas of serious erosion are limited to the wheat districts in the State of Rio Grande do Sul which have been under cultivation for rather a long time. Furthermore, these wheat lands receive the largest amount of annual rainfall in all of south Brazil, a rainfall which is very intensive in winter and spring when the land is being readied for cultivation and sown in wheat. The importance of the wheat-growing area, and of controlling erosion therein, is further emphasized by the fact that Brazil is a major wheat importer, and increased yields together with an enlargement in the area of cultivation are desirable in view of the rapidly growing population.

One factor which reduces the danger of erosion in South Brazil is the ethnic one. This area was settled for the most part by immigrants of central and southern European origin in the course of the last 100 years. These immigrants have built up a system of farming which is unlike the typical Portuguese pattern observed elsewhere in Brazil. The people have a much closer attachment to the soil, hence rotate their crops, and have in general adopted a more intensive type of farming than the native Brazilian who has a tendency to mine his land and then to proceed to virgin lands located farther to the west. However, these immigrant-established farms, especially those in the older settlements, are small and must be so intensively cultivated that they are in danger of gradually losing their natural fertility.

The Coffee, Cotton, and Cattle Zone of São Paulo

This area includes the central and western portion of the State of São Paulo, shown on the map by the A/B symbol.

This part of São Paulo has a gently undulating to rolling topography which is much more favorable to agriculture and to erosion control than the lands in the eastern part of the state. Topographically, there are no obstacles to the use of farm machinery through much of this central and western area.

The soils range from red lateritic clays developed on basalt and diabase formations to pink-colored sandy soils. Many combinations of both are found but the sandier soils predominate. In general the soils are chemically poor but their physical features are favorable to use.

Annual rainfall averages 60 inches. There is a dry season lasting for about five months which becomes longer and drier as one proceeds from south to north. The natural vegetation was mainly forest.

Wherever possible coffee was planted in this area. By allowing the laborers to interplant subsistence crops between the rows of coffee trees it was possible to lower the cost of production; at the same time the system proved most damaging to the soils. After its exhaustion by coffee the land was planted in cotton for a number of years. In the western part of São Paulo, where large areas were too low for coffee cultivation, a sequence of forest-rice-cotton

was practiced. After cotton the land returned for the most part to brush and was at best suited to poor pasture. At the same time new western lands were put to coffee, cotton or some other cash crop in what has been described as a "steam roller" movement leaving behind it a "hollow frontier."

Today the westward extension of this system of intensive exploitation and subsequent abandonment has almost reached its physical limits, represented by the Paraná River, which forms the western boundary of the State of São Paulo. Beyond that river, in the wide open spaces of the State of Mato Grosso, neither the soil nor the natural vegetation, which is grass rather than forest, are suited to the establishment of a system of cultivation which has made São Paulo rich but has ruined many of its best soils. Northern Paraná, which is considered as part of this area, has witnessed the most recent extension of coffee cultivation from São Paulo; however, here the rich red earth is highly suited to coffee and erosion is not yet a major hazard.

The type of agriculture of this frontier region may be described as a migratory, cash-crop system. The mining of the land was the result of a desire for quick profits on the part of agriculturalists with little attachment to the land. This urge for quick exploitation and immediate high returns was enhanced by the construction of railroads extending westward from the city of São Paulo into these forested lands selected for coffee production. There are numerous areas throughout the world where this type of agriculture on virgin lands is being practiced. In Brazil, however, the *next* stage has already been reached. Although damage has been extensive, erosion control is only one of the remedies. What these areas need primarily is the rehabilitation of "mined-over" lands through intensive farming methods suitable to the present physical condition and fertility of the soil and feasible under existing economic conditions. Erosion control is an important factor in the rehabilitation of such lands but it should be part and parcel of an over-all program rather than be carried out for its own sake.

Many of São Paulo's soils will undoubtedly respond well to management techniques and to the application of lime, phosphate, and other needed soil amendments. Nevertheless, it will not be possible to achieve economically satisfactory results in all cases. Hence, one of the most important features of the soil investigations will be a soil survey to determine and report on the types of soil where the chances of rehabilitation are better than even.

In order to point up the advantages of more intensive farming, the government must convince farmers that the new methods which are being advocated will bring greater returns than the methods used in the past. This should be done in the same manner as the government's successful demonstration of the profitableness of planting eucalyptus trees on formerly poor pastures. Once the farmers are convinced of the benefits of conservation farming it is not difficult to introduce new erosion control measures. Any farmer will understand that it does not pay to apply fertilizer only to have it washed away by a heavy downpour; or to improve the surface soil by the use of legumes without simultaneously controlling runoff on this improved surface.

So far only the physical factors have been emphasized. However, it is necessary to pay close attention to economic and institutional factors which might facilitate the change-over from a migratory type of agriculture to a sedentary and more intensive system. In this connection governmental action will be required to put into effect new and improved credit systems and facilities, to improve the laws with respect to farm tenure, and to launch the campaign for the modernization of agriculture.

Central Brazil

This is the area of the crystalline complex—granites, gneisses, schists—in eastern São Paulo, southern and eastern Minas Gerais, the State of Rio de Janeiro, and Espírito Santo.

Steep slopes predominate in this region, although only relatively small areas are truly mountainous. There are extensive tracts of maturely dissected plateaus where local relief ranges from 300 to 500 feet and very few level areas remain. A gently rolling topography is found only in the southwestern portion of the State of Minas Gerais.

The annual rainfall averages 60 inches and there is a dry season of about five months.

The soils are reddish lateritic clays or sandy clays. In general, the soils are able to withstand poor farming practices for a rather long period. If they have not been too heavily eroded and are allowed to lie fallow for a time, their fertility is partially restored once the natural vegetation takes over and furnishes new soil nutrients. Given the opportunity, these areas would revert to forest in a relatively short time.

Most of the districts situated at elevations ranging from 1,500 to 3,000 feet are, or have been, under coffee. Thus northeastern São Paulo, Rio de Janeiro, and southernmost Minas Gerais have completed the coffee cycle; southern Espírito Santo and the frontier region between São Paulo and Minas Gerais, which have been mapped as erosion type B/C, have coffee plantations that are on the decline; and eastern Minas Gerais was planted to coffee rather recently. Most of central Brazil is either in pasture for beef cattle and dairy herds or is in a shifting type of subsistence agriculture. Whatever the present land use on former coffee lands, insufficient time is usu-

ally allowed for the restoration of soil fertility because of the pressure of population in this densely settled part of Brazil.

In order to achieve widespread results in central Brazil it is primarily the agronomist's rather than the agricultural engineer's task to devise a simple rehabilitation program which should proceed approximately along the following lines: (a) Pasture improvement: controlled grazing, introduction of suitable grass types and forage crops. (b) Shifting cultivation: this primitive system can be improved by introducing quick-growing, deep-rooted legumes and using strip cropping at the same time. (c) Intensive farming: to be developed in many small areas where soils, topography, etc., give a better than even chance of success. (d) Forest crops: wherever possible an attempt should be made to introduce reforestation in areas of shifting cultivation. Suitable tree species should be selected for various climatic and soil conditions. Thus, eucalyptus trees planted in the vicinity of São Paulo city have proven a successful financial venture and at the same time have improved the impoverished soils of the area.

Northeastern Brazil

This region occupies the "hump" of Brazil which juts out into the South Atlantic Ocean. It is bounded roughly by 41° W longitude and 14° S latitude and may be divided into three subregions, with rainfall the main differentiating factor.

1. *The Coastal Belt*—annual rainfall 40-60 inches. A narrow strip of bluffs with deep sandy soils directly along the shore. This strip is primarily in pasture. There is serious local erosion in the form of deep gullies (A/C). Farther inland there is a hilly belt (B erosion), underlain by granites and gneisses, which is predominantly in sugar cane. Some of the soils here are considerably leached, but they respond well to fertilizing. The former subsoils of locally severely eroded soils are also under sugar, which is a good protective crop. With decreasing rainfall away from the coast, the soils are shallower and do not respond so well to fertilizing.
2. *The Transition Zone*—annual rainfall 20-40 inches. The main crops here are corn, manioc, and perennial cotton. The soils are underlain by granite and gneiss; they are light in color, shallow and stony, but rather fertile. The topography ranges from gently undulating to hilly. Although the average rainfall is higher in this transitional zone than in the drought zone to the east, this is the subregion in which a relatively dense population exerts heavy pressure on the land. Water conservation is the chief problem here; runoff must be decreased and the infiltration capacity of the shallow soil increased. Rocks and boulders are commonly used property boundary markers; they might be used more effectively in continuous rows along the contour to check runoff.

   A great deal of research is needed to formulate a better system of land use for this problem region. The introduction of drought-resisting food and forage crops would undoubtedly improve yields. In general, the geology and relief do not favor irrigation, because there are no high mountains to act as catchment areas and to feed local streams, and because the basement rock is predominantly igneous and therefore does not contain any major ground-water reservoirs such as would be found in sedimentary formations.
3. *The Interior*—rainfall less than 20 inches; considerable annual variation. This is northeastern Brazil's famous drought zone. In rainless years the sparse population engaged in marginal livestock grazing leaves this region *en masse* to escape starvation. Torrential downpours have caused geological erosion which has been accelerated by overgrazing. Conservation measures must deal primarily with range improvement, the introduction of drought-resistant forage crops and cacti, and the provision of watering places for cattle and goats.

Western and Northwestern Brazil Including Amazonia

These vast expanses of rain forest and savanna are either sparsely populated or completely empty. Erosion problems are purely local and are chiefly related to overgrazing. On the whole it is difficult at the present time to plan land management in a region whose chief problem is not poor land use but inadequate development for reasons of remoteness from potential markets, poor communications, and a shortage of people willing to pioneer under difficult environmental conditions.

Present Status and Future Prospect of Soil Erosion Control

On a government level Brazil has been erosion-conscious for a long time. The State of São Paulo established in 1939 what was perhaps the first soil conservation organization in South America. This unit, together with an extension division, has now been placed under the State's Department of Agricultural Engineering and Mechanics. Furthermore, the famous Agronomic Institute at Campinas (State of São Paulo) has been conducting experiments in soil conservation since 1943. Today, São Paulo State is administratively subdivided into ten conservation districts, each headed by an agronomic engineer with a small staff. A similar organizational set-

(*Continued on page* 237)

Industry's Stake in Conservation

WALTER C. GUMBEL

Industry's support of the conservation movement is just good business, points out the author in this article. Where the wise use of resources can be presented to industrial interests as a dollars-and-cents value, something that can directly affect their own economic welfare, then you can depend on their help. This is a basic concept which also applies to farmers and ranchers. The article also outlines some industry sponsored resource activities which have wide application.

THERE IS NO SUBSTITUTE for productive land, upon which man must depend for his food and much of his clothing and shelter. It is the basis of most of the nation's and world's wealth. Even the skyscrapers of Detroit, Pittsburgh and New York rest on the productive soils of America. We also depend upon the land for the production of water, for hunting and fishing, for outdoor recreation and for our lumber requirements. There is no other source—even in this atomic age! If America —its industries, its agriculture, its business and financial interests and its community life—is to grow and prosper, then its resources must be strong, plentiful and healthy.

Standard of Living Dependent on Ample Food

The limits of our great industrial system and our standard of living are invariably set by the available food supply which take about 26 cents out of each dollar. This has left a large balance of their income, amounting to approximately 74 cents, to be spent for the products of an expanding industrial system including professional services and conveniences that contribute to our standard of living. It would be impossible to maintain this standard without an ample supply of food at reasonable prices.

Just now, we are hearing much about agricultural surpluses. We need to keep our perspective clear and at the same time look ahead as far as we can and try to foresee the demands likely to be placed on the nation's agricultural plant. The problem, in my opinion, will be one of shortages—not surpluses. This assumption is based on the continued growth of population in the United States. Estimates of renewable resource demands during the next 25 years range from 25 to 40 per cent greater than current production. Based on these and other predictions by demographers, it is probable that less than a century from now the soils of this country will need to support a population double that of today.

There is not enough *new land* available to meet the expanding needs of the future. The rising demand for foods and other resource needs must come from increasing the per-acre yields of our crop and pasture land, and our range and forest lands. I feel certain that this can be done through new research and other technological advances. In the meantime, however, land resources are adequate to meet our needs for a long time to come, *provided we care* for them properly.

Let us, for a moment, take a quick look at the status of the non-renewable resources. The growth of industrial production has increased consumption of raw materials out of all proportion to our increase in population. This is based on an analysis of statistical records which show that the number of people in the United States doubled from 1900 to 1950, while the production of all minerals increased eight times, power 11 times, fuels 13 times, paper and paper board 14 times over the same period. In a number of instances, the use of raw materials greatly exceeds domestic production. Obviously, this means that we must turn to foreign imports to supply our higher level of living.

Technology Must Keep Ahead of Population

These are but a few of the more basic natural resource observations with which we as a nation are confronted. To meet our needs in the future, there is, as I mentioned before, one off-setting factor—the reliance on technological progress. Developments in research covering the renewable resources can be expected to further reduce soil and water losses and bring about improved soil structure, fertilization, hybrid seeds and animal breeding. Improved woodland management practices and resulting benefits in the form of hunting, fishing, recreation and, above all, the production of water, can also be expected. On the side of the non-renewable resources, progress must be made in the discovery of new sources of minerals and other essential elements in finding substitutes and in the reduction of waste. *America's position in world affairs and our desire to live as a free people makes it imperative that more than passing thought be given to the status of our basic resources—not only by government, but by industry, agriculture, business and financial interests.*

The question is often asked, "Why is this country so richly endowed, while older Asiatic and some European

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countries have extremely low standards of living?" Here in America an abundance of resources, to be sure, is a basic contributing factor. More important, however, is the fact that technological developments have kept ahead of the growth of our population. In countries where population pressures are great and resources have been dissipated, energies must be expended for the production of food which often takes 90 per cent or more of income. This makes it extremely difficult for modern technology to step in to do the job as we know it here in America—primarily because of the lack of available technical know-how and capital investment. *In other words, as long as technology keeps ahead of population growth, and our resources are developed and used wisely, we need not be too greatly concerned with future resource requirements.*

Water is a Basic Resource

Insofar as the present is concerned, there are some resource problems that need our attention—especially as they apply to industrial, agricultural and urban requirements. I would place water foremost in this category. There have been cries of water shortages to be sure. The fact remains, however, that there is no crisis—just problems galore. In this connection, I am told that the steel industry is consuming more than 13 billion gallons of water per day and by 1975 will be using 20 billion gallons. The chemical industry, now using 10 billion gallons, likely will increase to 30 in another 20 years. The 1975 estimate for the petroleum refining industry is 15 billion gallons per day, and for pulp and paper, 8 billion gallons.

It takes 1,500 tons of fresh water per year to maintain a United States citizen in the manner to which he is accustomed, and that's counting only the water drawn from rivers and lakes or pumped from the ground. It does not include the water that is channeled through power plants or the rain that falls on forest and farms and runs off to the sea. It requires 4,000 gallons of water to produce a bushel of wheat, 65,000 gallons for a ton of highly finished steel, 80 gallons for one kilowatt hour of electricity, and 100 gallons to produce a pound of rayon. Suffice to say, the estimate of industry's water requirements by 1975 is 275 per cent above what is now needed. How many of us consider water equally as important as coal, iron ore, salt and other basic raw materials? Industry's stake in water as a basic resource is clear.

There are other problems, too. Our growing needs for recreational facilities require greater development of hunting and fishing, of parks and forests and picnic areas. A population with more and more free time on its hands demands it; our growing recognition of what tourist trade can mean to our economy also demands it, as an out-and-out business proposition.

Where Does Industry Fit Into the Picture?

These are matters of extreme importance to every segment of our economy. Some of you may ask where do the coal producers, the steel fabricators, the food processors, and others fit into the picture? Not so many years ago we asked ourselves the same question "Where does the electric industry fit in?" I can assure you we still are finding new and plausible answers. We are convinced that our support of the conservation movement as it affects the renewable natural resources is just good business. Our success depends on the economic well-being of our customers and our customers, in turn, depend heavily on resources—soil, water, timber and wildlife. When a farmer's land wears out, we lose a customer, not only a customer for electricity but for all manufactured products. And too, when we waste valuable water we close the door on industrial expansion and improvement of living standards in the communities we serve. Both are dependent to a greater extent than ever before on water.

Our interest is selfish, yes; but perhaps that is the soundest kind of interest. For a number of years we have been encouraging others allied with our company to get behind worthwhile projects covering the wise use of the renewable resources for their own good. We are firmly convinced that when you are looking for allies in such an undertaking, the best approach is to look to those who have similar interests. Where the wise use of resources can be presented to industrial interests as a dollars-and-cents proposition, something that can directly affect their own economic welfare, then you can depend on their help. Even the churches have found that the dollars-and-cents value of conservation is related directly to their own existence and growth.

I mentioned our relationship to the farmer. My company, along with many other industries, have a heavy investment in him, gambling on the prospect that he will continue to farm and expand his economy to the point where we will get a return on our investment, if not through him directly, then through other business and industrial enterprises that stand to profit by his growth. If he fails, we are stuck. The farmer can move away; we cannot.

We have been growing into our conservation efforts by degrees for the past eight years. A few years ago we brought into one of our valleys a noted engineer to make a study of the watershed resource problems and needs and to recommend a plan of development. His report gave us a better understanding of the job to be done, and as we looked deeper we became more conscious of our stake in the land and its wise use and the long-range planning that would be necessary to finally obtain the development he recommended.

Figure 1. Industry's support of the conservation movement is just good business.

One statement was particularly impressive. In speaking of floods, the engineer said: "*Regardless of where dams are placed to control floods, without land use and soil conservation practices, 75 per cent or more of the flood damage to the land will continue.*" Taking this as our cue, we proceeded to enlist the efforts of others to begin thinking in terms of watershed development. It provided an excellent approach for cooperative effort by industrial, commercial, agriculture and recreational interests. Every aspect of resource conservation was involved, including soil erosion, depleted forests and wildlife, loss of farm and industrial income, pollution, floods, nutrition, and a host of others. These conditions touched everyone.

Helping to Implement the Efforts of Others

There was a lot to be done, mostly to create concern and an interest among the people of the territory we serve. Our soil conservation districts were doing a fine job, then as now, but the overall job of watershed development went far beyond the individual farm. Businessmen had to be shown that haystacks are as important as smokestacks to the economy of their communities; here and there we ran into the need for new legislation to support the things we are trying to do. Most of all, communities had to be made fully aware of their role in the planning. If the program to manage our land and water resources is to serve the best interests of all, it must be planned at the community watershed level.

My company does not presume or even suggest to be an "expert" on the subject of resource conservation. Our only aim is to help and implement the efforts of recognized conservation and educational agencies and the experts in any way we can. There are many organizations, including federal and state conservation agencies, that are justifiably classed as "expert" because they have been a part of the conservation movement for many years, employ technically trained people, and have devoted full attention to the subject.

We are not in conflict with any of them—and when I say "we" I am speaking for all business and industrial interests that have a stake in our resources and are involved in the job of helping; everyone is working toward a common objective; the only difference is that we are aiming at different audiences. We, the conservation "amateurs," do have certain facilities for reaching people who the experts do not have time to reach or cannot reach.

Who are the amateurs? They represent the automobile manufacturers, processors of food, agricultural publications, the press, banks, farm equipment and fertilizer manufacturers, mining interests, power companies, railroads, rubber and steel companies and many others. Amateurs, perhaps, but certainly not amateurs in a business sense. They have an economic interest in conservation because it means dollars-and-cents, and is basic to their enterprises and the economy of the nation.

Actually, there is no fixed plan for attacking the conservation problem. Our own experience has been that while we may be willing to take the bull by the horns, the sensible course is first of all to get our direction from the people who are best equipped to know what is needed—the people who have been trained in the field of conservation and resource development. After all, we are in the electric business, and expert as we may be in running our own operations, we are amateurs when it comes to things like conservation and agriculture. We *can help,* however,

Figure 2. Industry sponsors many types of resource development programs through displays, advertising, radio, contests and other equally good media.

with the facilities that are peculiar to our industry, and that is what we are trying to do.

Along with the more direct dollars-and-cents value, we figure our effort pays off in the form of good public relations. That, of course, is not a discovery original with us.

The Complete Treatment of Watersheds

The solution to the many and varied resource problems covering floods, soil erosion, water shortages, pollution, forest and wildlife management and others lies in a program that requires the complete treatment of entire watersheds. In this connection, I am not thinking of the Missouri River Basin but of areas like the Betsie in your own state of Michigan the Ten-Mile in West Virginia and other watersheds ranging from 15 to several hundred square miles. These areas comprise natural communities where local people and their local organizations can complete a watershed development program in a relatively short time. This approach also provides an excellent opportunity for the various federal, state and local governmental agencies to cooperate with representatives of industry, business, agriculture and other organizations at the local community watershed level. Resource programs of this type to be effective need guidance and direction.

With these principals in mind, the West Virginia State Chamber of Commerce, about four years ago, conducted a state-wide Watershed Development Conference. This was then followed by four similar conferences in each of our principal river basins, under the same sponsorship and in cooperation with industrial, agricultural, urban, wildlife, recreation and other related groups including the press. We were active in the promotion of these conferences which were designed to bring together all the related interests concerned with resource problems. Definite steps as a result of these meetings have already been taken to start the big conservation job at the local watershed level. Action programs cover soil erosion control, water conservation, forest management, restoration of wildlife, pollution abatement, increasing recreation opportunities, and others on a thoroughly integrated and coordinated basis.

The people living in these areas will have to depend on help from local, state and federal governments, to be sure, but they will be in a position to say "Here is what we want" and "Here is how we want it done." They have learned that agencies from the outside no matter how efficient, capable or sincere, cannot know the community's local problem as well as the community knows them. *What looks sound on paper is not sound if it disregards human principals.*

More than 1200 persons representing every segment of society participated and took part in discussions and group "workshop" sessions, held in conjunction with the watershed meetings. The conclusions reached were significant and covered specific resource and conservation development objectives to which everyone subscribed. In fact, they have broad application and could form the basis of similar watershed programs elsewhere. They are:

1. Recognition of the watershed as the proper unit for the wise utilization and development of all lands—crop, pasture, forest and wildlife.
2. Retardation and prevention of floods through the placement of small reservoirs and other water impounding structures at the headwaters of streams and in problem areas.

3. Provision for an abundant supply of water for domestic, industrial and agricultural needs.
4. Development of wildlife refuges and expansion of game food and cover programs.
5. Abatement of organic, inorganic and soil pollution in the streams.
6. Broad expansion of recreational facilities such as public parks, picnicking and camping grounds, with more lakes and streams suitable for boating and fishing.

In our analysis of these objectives, we feel that all lands should be treated in accordance with their peculiar needs and by methods that will control soil erosion, conserve water, enhance wildlife, improve farm income and prevent flood damage to agricultural lands. And further, the term flood prevention consists of special conservation methods designed to guide the raindrop into the soil and to protect the soil from erosion. Flood control is the basins and reservoirs constructed to hold excess water, and flood protection consists of dikes and levees put in along the river channel to protect property and land bordering streams.

Flood control and flood prevention in our opinion are not in conflict. They supplement each other but do not supplant one another. Reservoirs for flood control do not help the flood problems at the headwaters, but prevention upstream increases the value of downstream areas. The more you prevent the less flood waters you have to control.

Local Groups Have Resource Responsibilities

These objectives, as a group, represent the combined thinking of industrial, agricultural, business, financial and recreation interests. There is no conflict. Plans and developments are well along in translating these objectives into action programs on a community watershed basis; also to bring about their acceptance by the state as "state policy." It is our firm belief that states and local units of government must share in the resource development of their areas by providing leadership, finance and legal status. If this is not done, the only course left open is for the federal government through its appropriate agencies or commissions to do the entire job for the people. The Federal Government has definite resource conservation responsibilities and should work with and through the states wherever it is feasible.

Water is no respector of boundary—local, regional or state. Because of this we cannot, as representatives of industry, limit our efforts entirely to the local level if watersheds are to be fitted together in the kind of pattern that will serve the best needs of the nation. There must be guidance and direction that will fit those programs into our democratic way of doing things. This has not always been true. We have all seen the development of conservation programs, flood control and reclamation projects and many others—some often in conflict with each other. These situations have a bearing on how efficiently and effectively our local efforts contribute to the movement.

To clarify and correct these conflicting programs and idealogies, we need to look to Congress to enact a renewable natural resources policy covering land and water and the attendant benefits clearly setting forth the objectives and properly representing the regional and national interest. We do not now have such a policy. Perhaps the so-called Pilot "Watershed Protection" program covering some 60 specific areas, inaugurated by the 83rd Congress is a step in this direction.

The functions and operations of all Federal agencies having resources development responsibilities need to be reviewed because of current and future needs and provision made for coordination and the assignment of definite fields of activities. For instance, a total of seven federal agencies now have their fingers in water resources surveys. We have more than 2,000 laws concerning resource development. These need to be reviewed and properly codified. Then there is the need for enactment of suitable legislation covering resource development programs in the states. This is predicated on the fact that most states are also confronted with problems covering inadequate resource policies, too many non-related laws and conflicting interests among bureaus working in the operations field.

Some Industry Sponsored Resource Activities

All of these add up to a necessity on our part to expand our interest and participation in conservation from the local to the regional and national level. We can do this through our respective trade organizations, by using all the facilities at hand to express industry's viewpoint clearly and ably.

In addition, there are many other activities in which industrial, business and finance groups may engage to further implement and promote resource development programs. The following are a few which have broad application.

1. *Advertising and publicity.* Preparation of conservation advertisements for placement in newspapers and magazines; also the preparation of similar materials for radio and television programs. Development of conservation exhibits and display materials for use in store windows, meetings, fairs, schools and other public places. Provide visual aids including kodachrome slides, film strips, movies, display photographs and other means to further emphasize the conservation story.

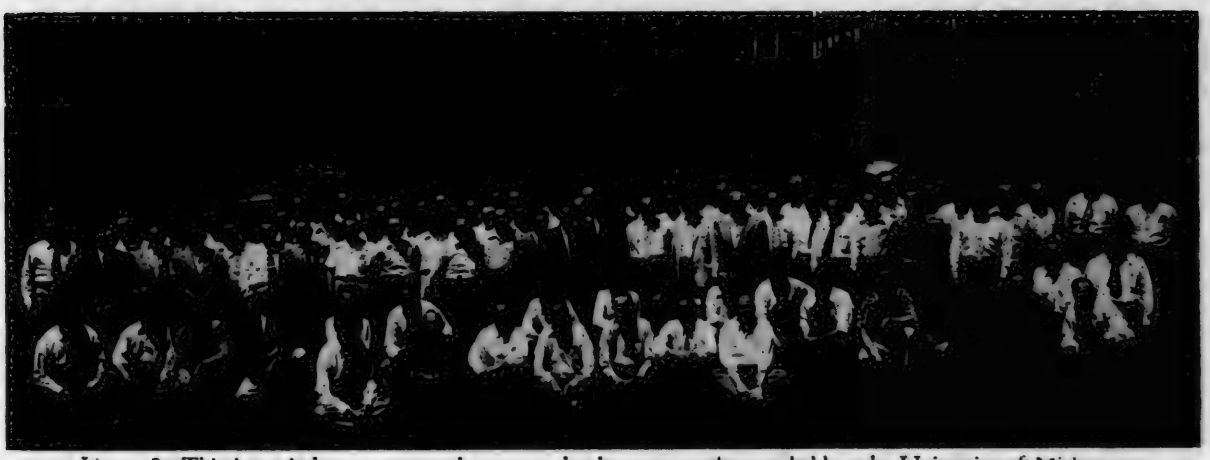

Figure 3. This is an industry sponsored resource development conference held at the University of Michigan.

2. *Conservation contests.* Co-sponsor with local soil conservation districts, schools, youth groups and other conservation interests, contests featuring (a) land judging and appreciation, (b) conservation essays and public speaking contests, (c) demonstrations emphasizing resource development for adult and youth groups.
3. *General Conservation Education.* Encourage the formation of conservation education workshops at local and state levels for teachers, industrial leaders and youth groups, arrange conservation forums in high schools, in colleges and through community organizations. Provide scholarships for boys and girls; also for teachers who are planning to attend summer conservation camps and workshops.
4. *Field days and tours.* In cooperation with local conservation leaders, plan tours and field days for company personnel and customers, for representatives of industry and business, women's groups and others so that they may better understand what conservation is and how it is related to their individual interests.
5. *Promotional activities.* Provide well-informed speakers on conservation for urban and industrial programs, sponsor public speaking contests, prepare informative leaflets and brochures featuring conservation, cooperate with other industries in presenting a common front, take out affiliate memberships in local soil conservation districts, The Izaak Walton League, The Soil Conservation Society of America, local Watershed Development Associations and other recognized groups concerned with resource use and conservation activities.
6. *Treatment of company-owned land.* Where necessary, seek the cooperation of the local soil conservation district technician or state game commission representative for assistance in the development and application of suitable land, water, forest and wildlife programs.

The wise use of our resources is one of America's biggest and most pressing problems, not just because of its effect on the land but because it is a sound approach to an even bigger problem that affects our way of life. The management of farm and ranch lands, and the nation's watersheds is involved. Our resource conservation approach is also in sharp contrast to governmental control and development. The objection to the latter is its socialistic implications—the tendency of central government to accept only too willingly the individual responsibilities that we are letting slip away from us. The present administration in Washington has been helpful by emphasizing that resource programs are to be developed on a partnership basis. This is as it should be. In the meantime, however, let us not delay our efforts but rather accept our share of the responsibility by becoming a real partner at local and regional levels. This must be done now for tomorrow may be too late.

"Our forefathers came (to this country) with the Bible in one hand and the rifle in the other. Some of their descendents have lost the rifle; some the Bible; some both the Bible and the rifle. Let us restore the confidence and strength that a knowledge of the rifle brings. Let us restore the spiritual strength the Bible gives! Let us help to bring back both by the purchase of a piece of the big 'Outdoors', where strong men in spiritual power find the best of nourishment".

—Harry B. Hawes

Grassland Farming Provides Year Around Grazing

L. A. JACKSON AND H. E. VAN ARSDALL

Members and friends attending the Annual Meeting of the SCSA will have an opportunity to visit the W. H. Clark ranch described in this article. The program typifies the kind of land use program which is transforming the south into a grassland economy.

GRASSLAND FARMING that provides year around grazing is the goal of most ranches in the southeast. W. H. Clark in the relatively short period of four years has developed such a system on his 1120 acre ranch in Florida's Nassau Soil Conservation District.

A soil conservation plan with his District was worked out soon after the purchase of the land. Clearing, fencing of fields, drainage, pond development, irrigation and wildlife plantings as well as the development of adapted grasses and legumes were all important features in the plan agreed upon in 1950.

The heavy Bladen and associated soils of the III, IV, and Vw classification made it necessary that drainage to remove surplus surface water be planned and arranged for first. Fence locations were determined as a result of the overall drainage pattern with adequate cross fencing incorporated to provide for controlled grazing. The use of 30 fields on the 750 acres cleared to date indicate the extent that rotation grazing is followed to obtain maximum production of pasture plants.

L. A. Jacobson is area conservationist for the Soil Conservation Service and chairman of the Florida Chapter of the SCSA. H. E. Van Arsdall is management agronomist for the Soil Conservation Service and secretary-treasurer of the Florida Chapter. Both men are located at Lake City, Florida.

Mr. Clark states, "*Adequate soil preparation and the growth of a green manure crop of Sesbania immediately preceding pasture establishment has helped to assure rapid growth following seeding.*" Clark goes further than this and smoothes his land before seeding to facilitate the operation of maintenance and forage harvesting equipment.

Cool season grasses, Ky. 31 fescue, and the Chapel Hill strain of rescue, occupy a little over one third of the land. The remainder of the developed land is in summer grasses adapted to this section of Florida. The grasses Argentine and Pensacola Bahia, coastal Bermuda, Dallis, Pangola, and carpet have white or crimson clover volunteering each winter. Italian rye grass is also seeded in the Pensacola Bahia and carpet grass each fall for additional winter feed. Surplus summer growth is cut for hay. The irrigated coastal Bermuda is yielding up to ten tons per acre.

In addition to producing hay from surplus summer grass, seed of the fescue and rescue grass is saved in the spring. The rescue is mowed after seed harvest and baled for hay.

Soil Conservation Service Nurseries made available through the Supervisors of the Nassau Soil Conservation District some of the initial plant materials for the pasture and wildlife plantings. These materials included

Figure 1. *Left.* William Howell, manager of the Clark ranch on the left and Lantis H. Strickland, work unit conservationist for the Soil Conservation Service examine a fine stand of Argentine Bahia grass on Class IVw soil. *Right.* Brahama cattle grazing on white clover and Dallis grass.

brush lespedeza, multiflora rose, Arlington strain of Kentucky 31 fescue, Argentine Bahia and Chapel Hill rescue grass.

As a result of good management and adequate fertilization 300 brood cows are maintained on this ranch with a minimum of hand feeding. Hay and supplement is fed only during periods of drouth or extended cool weather when grass and legume growth is retarded. A calf crop in excess of 95 per cent has been obtained for the past two years.

Mr. Clark took advantage of the facilities of his local soil conservation district to develop the wildlife possibilities on his ranch along with cattle production. Deer, wild turkey, and quail are increasing as a result of increased feed produced. A three acre pond containing 25 acre feet of water was constructed at the ranch headquarters for fish production and to provide water for irrigation. Mallard ducks and Canadian geese grace the pond. The pond is also fertilized for maximum fish production, producing bass and blue gill bream. Shrub lespedezas have been established on field borders and permanent fences of multiflora rose are well started. Good fertilization and protection from grazing have been responsible for the success of these plants.

Soil Erosion Survey

(*Continued from page 229*)

up exists in the State of Minas Gerais but here progress has been impeded by the lack of both funds and trained personnel.

There is considerable academic interest in soil conservation, as witnessed by the 1947 Congress on Soil Conservation and the round table conferences held in São Paulo in 1949 and 1952. The Institute of Agronomy in Campinas, and the Council of Geography have sponsored a number of good technical studies.

Nevertheless, Brazil is still far from having an integrated and efficient soil conservation program. It should be pointed out here that of all Latin American countries Brazil faces some of the most formidable obstacles (such as size of country, poor accessibility of interior, and diversity of physical conditions) to the introduction of a rational, all-embracing control program.

So long as the quest for quick and spectacular return on investment remains pre-eminent in Brazilian economic thinking, no long-range improvement plan, however well designed, can gain widespread acceptance among the mass of Brazilians who live on the land. That is why the availability of ample capital for long-range development at a relatively low interest rate, despite the lack of immediate prospects of return, is a basic prerequisite for the improvement of agricultural practices in Brazil.

On the positive side, it should be reported that the authorities are beginning to understand that soil conservation is not limited to the introduction of engineering structures, and that the widespread adoption of such relatively simple devices as planted hedges to stop sheet wash, contoured grass strips, etc., is preferable to the construction of terraces, particularly where annuals are grown. Furthermore, Brazilians are increasingly conscious of the need for simpler and more practical measures that are suited to the country's physical and cultural conditions; accordingly, there has been a shift away from the more advanced, more expensive, but less widely applicable methods advocated in the past.

Reed Canarygrass

(*Continued from page 209*)

of western Iowa. Mr. Harms has obtained a great deal of personal satisfaction in whipping this erosion scar with reed canarygrass.

Great personal satisfaction comes to the individual who takes a bag of seed, a basket of sods, or a bundle of stems and does something constructive in arresting and curing those "farm cancers" known as gullies. Once established, reed canarygrass will be there indefinitely, guarding against erosion.

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Book Reviews

CONSERVATION IN CANADA. *By* O. M. McCONKEY. *J. M. Dent & Sons (Canada) Limited. Toronto—Vancouver, 1952. 210 pages. 70 illustrations. 7 diagrams. $3.50.*

A timely and comprehensive treatment of Canada's problem of conserving natural resources. The author treats his subject with knowledge and as one who is deeply devoted to the cause of conservation.

Canada is one of the few remaining virgin areas of the world and is rich in forests, soil and water resources, and minerals. The author points out that while these resources have been used to build Canada, too little is presently being done to protect and conserve that which remains

In particular, Dr. McConkey points up the annual loss of soil and water as one of the most serious problems facing Canadian agriculture today.

Several chapters are devoted to background and basic information dealing with climate, soils, and natural cover of Canada which the reader will find essential in appraising other portions of this book. The need for research and soil inventory in planning and applying soil conservation is stressed.

Soil and water conservation problems are discussed in detail in successive chapters along with remedial measures that may be adopted to give some measure of relief from their deleterious effect on land and water resources.

In concluding his discussion of conservation in Canada, the author briefly touches upon the relationship between conservation, health and nutrition, industry, and recreation. He further suggests that education in conservation is an urgent need throughout Canada.

To provide the vehicle for added conservation of Canada's resources, the author calls for a Federal Conservation Act covering the natural resources of the nation and coordination of the departments of government concerned with natural resources at both Federal and Provincial levels. He further advocates a Federal Plan of Conservation, integrated with Provincial plans.

This book is one that can serve as a reference for the student of conservation as well as being classed in the category of interesting and informative material and a contribution to our study of conservation problems in relation to modern civilization.

—VAL J. SILKETT, *Des Moines, Iowa*

DAVID'S RANCH. *By* DON WILCOX. *Julian Messner, Inc., New York. 62 pp., illus. by Louis Zansky. 1954. $1.60.*

One of a series of "Everyday Science Stories" by this publisher, *David's Ranch* is a tailor-made, educational "western" aimed at children 8-12 years old, in grades 4-6.

It dramatizes some of the hazards of ranch management, the deceptive lure of the extra dollar, the evils of overgrazing, and important lessons of soil and water conservation.

The illustration of David, the busy rancher's son, given a 15-acre pasture to manage as his own, its a bit too obvious for the adult mind. Whether active boys of the age-group mentioned will read it in competition with the more lively westerns and science-fiction so abundantly available is doubtful.

At any rate, the effort is laudable, and one can take no exception to the facts presented. This has been assured by having the technical information checked by the Soil Conservation Service.

—BEN OSBORN, *Midland, Texas*

THE OXFORD SYSTEM OF DECIMAL CLASSIFICATION FOR FORESTRY. COMMONWEALTH AGRICULTURAL BUREAUX, *Farnham Royal, England. 115 pp. 1954. 10 shillings.*

The new Oxford system designed to classify forestry bibliography contains a section of special interest to soil and water conservationists. This is Section 1, entitled *Factors of the Enviroment*, and *Biology*. Its close scrutiny may reward some of the students, research workers, and practitioners in these fields who are looking for a more efficient way to classify their own books and pictures, or who have a general interest in technical libraries.

Following the decimal principle (e.g. that each number in the system is preceded by a decimal point), Section 1 expands as follows:

11 Site factors: climate, situation, soil, hydrology conservation and erosion)
12 General biology
13 General zoology
14 Systematic zoology
15 Animal ecology
16 General botany
17 Systematic botany
18 Plant ecology
19 Miscellaneous

Under 11, *Site factors*, we have decimal expansion into 34 main subdivisions, ranging from meterology and microclimate, to soil profiles, soil classifications, runoff, and erosion. Some of these subdivisions have a decimal breakdown into as many as twelve parts. It is obvious from this refinement that the Oxford classification provides a systematic coverage of these subjects in a way admirably suited to the modern technician's needs.

Lest anyone conjecture that the Oxford System is a devising of some dreamy philosopher who seldom rises form his dusty tomes, it should be noted that the scheme was created through the cooperative work of a committee

including several eminent European foresters. A top-level bibliographer of the Commonwealth Forestry Bureau (publishers of *Forestry Abstracts*) performed the gigantic task of blending divergent contributions into a systematic whole. The final publication, labeled the *Authorized English Version,* is sponsored jointly by FAO and the International Union of Forest Research Organizations. Its price of 10 shillings is equal to about $1.40.

The balance of Sections 0-9, not covered in this review, present a detailed analysis of such distinctive aspects of forestry as silviculture, logging, protection, management, forest products, and economics.

—FRANCES J. FLICH, *Washington, D. C.*

LIMESTONE. *By* C. M. LINSLEY. UNIVERSITY OF ILLINOIS. *Circular 721, Urbana, May 1954. 12 pages.*

Professor Linsley begins this short but informative circular with the statement that "Illinois farmers have used a mountain of limestone," or 62 million tons in the last 15 years. Liming is an important step in the Illinois system of "permanent fertility" along with: (1) soil testing, (2) application of plant nutrients, (3) legume production, (4) returning crop residues and manure to the soil, and (5) controlling erosion.

A faithful adherent to the rule that at least ¼ of cropland should be used to produce legumes, Linsley points out that limestone, as well as phosphate and potash, are necessary for production of heavy legume crops. Limestone neutralizes soil acidity and thus prevents the change of phosphorus to relatively unavailable forms. A sweet (nonacid) soil encourages the growth of desirable organisms such as the nitrogen-fixing bacteria and those which bring about the decay of organic matter.

The circular contains much information on the neutralizing power of various kinds and sizes of liming materials, as well as when and how to apply them. Extra care in application will pay dividends because an uneven job of liming may result in a loss of 15 to 25 tons of hay on a 40-acre field.

While limestone is important, phosphate and potash are also necessary. Professor Linsley emphasizes the fact that these three materials should be applied according to the soil test. Proper soil treatment and legume production are the main points in improving Illinois soils, he believes.

In determining the value of limestone, an average of returns from 21 Illinois soil experiment fields is used. The farmer might be more interested in the returns from individual fields. However, in a short publication this lack of detail is not an important point. The circular is well illustrated with diagrams and photographs and is extremely readable.

—WILLIAM H. HENEBERRY, *Urbana, Illinois*

Helpful Booklets from Advertisers

We are, in cooperation with our advertisers, listing booklets printed by them which will be of interest to you in your work as a conservationist. The booklets are free and may be obtained by checking the squares and filling in the form below. This information should be forwarded to the Soil Conservation Society of America. Your request will then be sent to the company concerned.

☐ **FERTILIZER APPLICATION GUIDE FOR MAJOR FIELD CROPS;** 42 pages illustrated; how to get the most from your fertilizer dollar. New Idea Farm Equipment Co., Coldwater, Ohio.

☐ **PIONEERS OF PROGRESS;** 32 pages, a cartoon history of agriculture in America from 1620 to today. Minneapolis-Moline Company, Minneapolis, Minnesota.

☐ **FUN ON THE FARM;** a 24 page coloring book of farm scenes for children. Minneapolis-Moline Company, Minneapolis, Minnesota.

☐ **U. S. FOOD FACTORY;** a 48 page booklet showing how population increase puts pressure on farmers and ranchers for more production. Covers all phases of conservation, illustrated. International Harvester Company, Chicago, Illinois.

☐ **MAKING PAYDIRT LAST;** 16 pages, illustrated, covering the subject of practical conservation methods for all acreages whether large or small. It shows how modern farm equipment can be used for practical soil conservation work. Allis-Chalmers Manufacturing Company, Milwaukee, Wisconsin.

☐ **WHY LEVEL?;** a discussion of the application of the leveler to all types of farming conditions and the leveler application to soil conservation practices. Eversman Manufacturing Company, Denver, Colorado.

☐ **LAND SMOOTHING . . . KEY TO ORDERLY WATER DISPOSAL;** an article covering the use of land levelers for both irrigated farming conditions and as a drainage practice in the humid areas. Eversman Manufacturing Company, Denver, Colorado.

☐ **ONE EQUALS FOUR (PASTURE MANAGEMENT);** a treatise on modern methods for permanent pasture lands in the eastern half of the United States and Canada. J. I. Case Company, Racine, Wisconsin.

☐ **LAND OF PLENTY;** An excellent and well illustrated historical portrayal of the contribution made by the farm equipment industry in farm mechanization. Farm Equipment Institute, 608 South Dearborn Street, Chicago 5, Illinois.

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Field Notes and Comments

Program Announced for North American Wildlife Conference

The stake of the United States, Canada, and Mexico in the restoration and management of their renewable natural resources will be emphasized at the 20th North American Wildlife Conference, which will be held in Montreal, Canada, next March under the sponsorship of the Wildlife Management Institute. Attention will be focused on the most urgent resource problems facing North America today.

No phase of the conservation and management of natural resources will be omitted from the broad program, which will include discussions by leading international figures ranging from the basic resources of soil and water to the management of their living products. Wise use of all renewable natural resources will be stressed in the nine sessions of the three-day meeting. Present world conditions make imperative a definite evaluation of our present and future policies toward these natural resources.

The conference program is being formulated around the central theme:

"Natural Resources Use—A Continental Challenge"

Approximately 60 papers will be selected for presentation during the sessions that will be held on March 14, 15, and 16, 1955, in the Sheraton-Mount Royal Hotel, one of Montreal's best equipped hotels. All papers and the recorded discussions from the floor will be published by the Institute, as formerly, in the printed transactions of the Conference.

International Soil Science Meeting

Roy D. Hockensmith, a member of the SCSA Council attended the Fifth Congress of the International Society of Soil Science which was held August 16-22, in Leopoldsville, Belgian Congo, Africa. He was chairman of the Commission on Soil Technology and was responsible for organizing that part of the program that deals with soil conservation, erosion control, land drainage and irrigation and soil tillage, as well as conducting meetings at which papers on these subjects were presented. Following the meeting, Mr. Hockensmith spent two weeks on an excursion in various parts of the Belgian Congo.

Improved Survey Flag Pin for Field Layouts

Technicians at York, Nebraska, are enthusiastic about an improved type of survey pin they have been using the past several years. It is made of small wire, bale-tie gauge, 21 inches long with a red or white plastic flag, 2½" x 3½", at one end.

These survey pins were developed by a former Soil Conservation Service employee to replace the lath stakes then in common use throughout this region. They are now available commercially at $9 per thousand with a discount on quantity orders.

They are used to make contour and terrace lines, diversions, waterway boundaries, to stake out stockwater dams; as preliminary grid stakes for land-leveling, for lining out topographic surveys, and for lining up rows on tree planting sites. Cut-and-fill depths may be written on the white flags with a ball point pen. The flags are handy for spotting blue top grade stakes, toe stakes, and for installing overflow pipe risers. The pins can be woven into or wrapped around fence wire to mark contour or terrace lines, with the line number written on the flag.

Although such pins properly may be considered expendable, the same ones have been used repeatedly in the York County Soil Conservation District. Farmers and

Coming Events

Oct. 6-7, 1954	Friends of the Land, Zanesville, Ohio
Oct. 24-27, 1954	Society of American Foresters, Schroeder Hotel, Milwaukee, Wisconsin
Nov. 8-12, 1954	American Society of Agronomy & Soil Science Society of America, St. Paul Hotel, St. Paul, Minnesota
Nov. 15-17, 1954	**Soil Conservation Society of America, Hotel George Washington, Jacksonville, Florida**
Dec. 6-7, 1954	National Watershed Congress, Statler Hotel, Washington, D. C.
Dec. 26-31, 1954	American Association Advancement of Science, University of California, Berkeley, California
Feb. 1-5, 1955	National Association of Soil Conservation Districts, San Diego, California
Mar. 14-16, 1955	North American Wildlife Conference, Sheraton-Mount Royal Hotel, Montreal, Canada
Apr. 25-May 2, 1955	International Arid Lands Symposium and Conference, Albuquerque and Socorro, New Mexico

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contractors have been encouraged to save the pins and return them to the work unit office.

The plastic flags do not curl or become stringy, as do cloth flags. The bright color is easy to see, even in considerable stubble, and does not fade much when left standing for long periods of time.

With all his enthusiasm for the pins, Glenn A. Feather, work unit conservationist, warns that some caution should be observed. Cattle seem to like the plastic flags and will chew them more than cloth flags. The lightweight wire tends to bend when being forced into extremely hard ground. This can be overcome somewhat by holding the pin near the point. High weeds or tall-growing crops limit use. In cornfields, however, York technicians sometimes insert the pins into the pith of the standing stalks after the tips had been broken off at a node.

Notwithstanding the occasional disadvantages noted, these pins have speeded up the work during the rush of the spring layout season. They are handy when fields are too wet for plowing terrace lines but not too wet to prevent planning. By leaving the pins in place for plowing later by the farmer, 25 to 40 per cent more layout jobs can be done by the technicians in a rush season.

—WILLIAM H. TEAS

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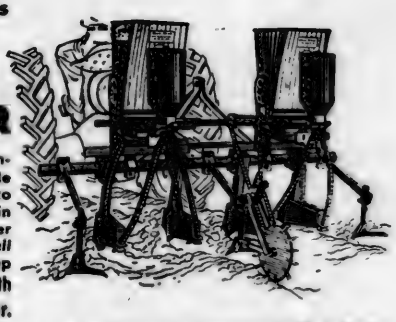

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SOME NEW INDUSTRY PRODUCTS

Hydraulic Land Levelers

The Eversman Manufacturing Company announced recently through some nine hundred dealers located in every part of the nation two new hydraulically controlled Land Levelers and Dirt Movers, now making six different models in all.

The new levelers, known as 9H and 12H, with full hydraulic control of the cutting blade from the tractor seat, are companion models of the famous 9PL and 12PL power lift models which are now being used on some 85,000 farms throughout the nation. Power required is a 2-plow tractor for the 9H and 3-plow tractor for the 12H. Both models are shipped less hydraulic cylinder and hoses and any standard A.S.A.E. double acting cylinder can be used. This is an excellent feature as it saves the farmer the necessity of buying additional hydraulic equipment.

These machines are used by farmers in all territories to prepare land for more efficient irrigation, improved surface drainage, erosion control, superior seed beds and better farming.

New Eagle Share

The new low-cost Case Eagle share saves trips to the blacksmith because it never needs sharpening all during its long plowing life. When finally worn

down, another is quickly put on. It is used with the new Case Eagle bottom which turns an excellent furrow at speeds from slow to extra fast in a wide range of soil types. The Eagle share is made of special steel almost as resilient as spring steel, able to take severe shock without bending or breaking, and slow to wear. High strength throughout makes the bottoms unusually resistant to damage. They will fit most Case plows now in use.

Pasture Renovator

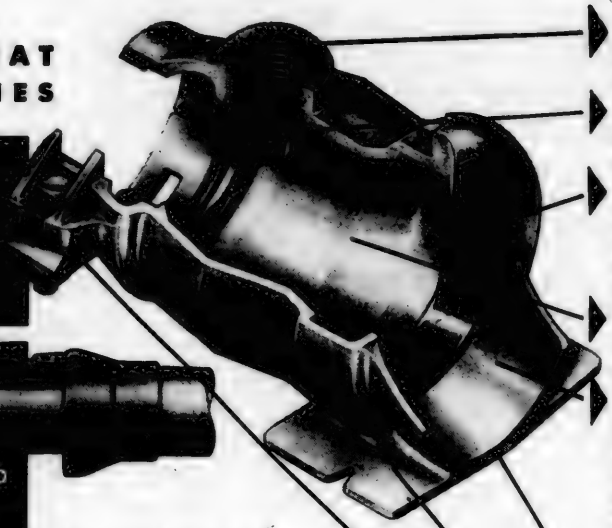
A new machine with which wornout pastures can be reseeded and fertilized without losing a single day's grazing is announced by International Harvester Company. This new development, designated the McCormick No. 1 pasture renovator, is believed to have special emergency application in renewing pastures weakened by last fall's severe drouth in many sections of the country.

The new pasture renovator may be de-

2 GREAT COMPLETE LINES

SHUR-RANE
SERIES 400F
WITH ATTACHABLE COUPLERS

LOCKJOINT
SERIES LJ
WITH FACTORY ATTACHED COUPLERS



Deep, clean cut threads in a sturdy riser boss for riser connection.

"Internal Pipe-Stop" keeps male end of pipe out of riser opening.

Neoprene Gaskets are leak-proof under high or low pressure, easily installed, long lasting, protected by deep recess.

Large unrestricted water passages and reinforced working areas.

Unobstructed entrance to coupler. Curved-apron pipe-guide makes pipe inserting easy. It is not necessary to walk to coupler to disconnect or connect pipe. Either operation can be handled in a comfortable standing position at center of pipe.

Curved-apron pipe-guide is raised to prevent dirt and debris from entering coupler as pipe is inserted.

Wide, flat, stable footpad keeps tall risers upright.

Bolted clamp connects coupler to pipe. No welding or punching necessary. Coupler is securely attached easily and quickly with hand tools.

Industrial uses too! ... MINING, DREDGING, EXCAVATING, CONSTRUCTION AND FILL

Industrial Fitted Pipe—Plain Footed

See your local dealer for free engineering and planning service.

Write for new Bulletin No. 20.

Designed, Engineered and Manufactured by

FLORIDA DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
LAKELAND, FLORIDA • P. O. BOX 1718

fmc

scribed as a three-in-one machine. In a single operation it (1) applies fertilizer below the surface of the ground, as deep as four inches; (2) drills a nurse crop; and (3) sows grass or legume seed. Fertilizer and seed are applied in narrow bands 11 inches apart. Existing sod is scarcely disturbed by the action of the specially shaped, colter-type openers.

Diesel-Powered Motor Grader

Constructing irrigation ditches and building and maintaining farm access roads are two of the most important jobs performed by this Allis-Chalmers AD-40 Diesel-powered motor grader on the R. S. Rhodes Farm two miles east of Beardsley, Arizona.

To irrigate the 2,000 acres of land under cultivation for cotton, alfalfa and barley, the Rhodes farm maintains 24 miles of water and 24 miles of drainage ditches. It also helps maintain three airstrips that have been built on the farm. Other modern equipment to aid in its farming activities are six Allis Chalmers cotton pickers and a AD-4 Diesel-powered crawler tractor.

Benson Sets Up Advisory Group on Conservation

Invitations to participate in a meeting on resource conservation have been issued to 20 persons by Secretary of Agriculture Ezra Taft Benson. The meeting is scheduled to be held in Washington, D. C., September 29-30.

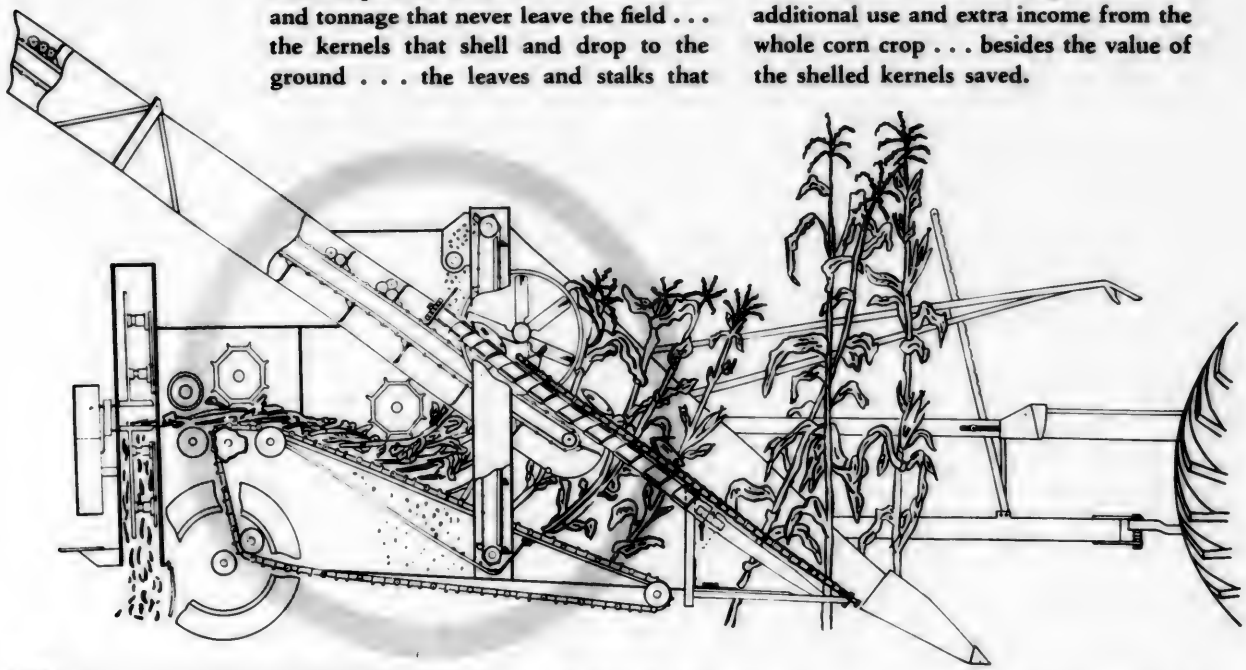
The purpose is to advise the Secretary in connection with resource conservation problems, including research, education, credit, technical assistance, cost sharing and related problems.

Invitations to the Washington meeting were sent to:

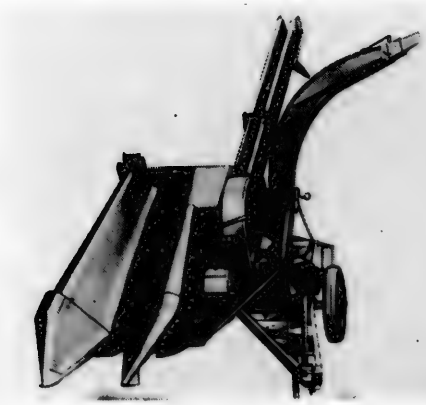
LEROY DONALD, *El Dorado, Arkansas;* W. B. CAMP, *Bakersfield, California;* FERRINGTON CARPENTER, *Hayden, Colorado;* DR. R. G. GUSTAVSON, *Washington, D. C.;* W. HOUSER DAVIDSON, *Fort Valley, Georgia;* GEORGE SCARSETH, *Lafayette, Indiana;* KIRK FOX, *Des Moines, Iowa;* FLOYD E. LULL, *Smith Center, Kansas;* L. ROY HAWES, *Boston, Massachusetts;* ALF LARSON, *Hayfield, Minnesota;* CHARLES MARSHALL, *Lincoln, Nebraska;* DR. FIRMAN E. BEAR, *New Brunswick, New Jersey;* THOMAS D. CAMPBELL, *Albuquerque, New Mexico;* DR. RICHARD BRADFIELD, *Ithaca, New York;* DAVID S. WEAVER, *Raleigh, North Carolina;* CHARLES A. DAMBAUGH, *Columbus, Ohio;* NOLEN J. FUQUA, *Duncan, Oklahoma;* CHARLES A. WASHMON, *Harlingen, Texas;* HENRY T. MCKNIGHT, *Vienna, Virginia;* CORYDON WAGNER, *Tacoma, Washington.*

Saves THE LOST BUSHELS

Only that part of the corn crop that's either sold or fed puts money in the farmer's pockets. But what of those bushels and tonnage that never leave the field . . . the kernels that shell and drop to the ground . . . the leaves and stalks that could make dry roughage, low-cost silage . . . excellent bedding? Salvage of this part ordinarily lost would be a big windfall . . . additional use and extra income from the whole corn crop . . . besides the value of the shelled kernels saved.



That's why Case dug deep to serve, to give farmers a way of full use of their corn crop. Via the routes of research and design, Case engineers have developed a machine that saves bushels per acre, the loss usually incurred by mechanical picking. Kernels ordinarily lost going through picking rolls drop to a floor underneath the stalkway. A chain rake, in turn, delivers them to the elevator where they join the ears on the way to the wagon. The drawing above and the photo to the left show this new, shielded feature.



There's an equally great crop-salvage feature, one that provides a new kind of bonus to cost-conscious farmers. In the same operation of picking, the Case Corn Harvester chops or shreds stalks and leaves. In terms of crop savings, it takes tough vegetation . . . cuts it into desired lengths and blows it into a forage wagon for low-cost, filling feed or absorbent bedding. For those who prefer, it chops or shreds stalks into fine material . . . returns it direct to the ground for rapid decay, also making plowing and disking much easier and faster. At left is the Corn Harvester equipped to deliver chopped stover into trucks or wagons. J. I. Case Co., Racine, Wis.

CASE

Big Yields Burn More Humus

Above left: The new New Idea shredder has three shredding heads with adjustable hammers. Outside shafts rotate in opposite directions. Cleans two rows *and* center.

Above right: New Idea-Horn loader has fast lift, high reach. Handles loads up to 2,500 lbs. Low profile permits working in cramped quarters. 10 easy-on attachments do 101 other jobs. Fits more than 100 tractor models.

Below: Four New Idea spreader models, including a 120 bu. PTO job, give you a wide choice of capacities to fit your requirements. Wide range of spreading rates controlled from tractor seat.

NEW IDEA
FARM EQUIPMENT CO.
AVCO Distributing Corporation
Dept. 1383, Coldwater, Ohio

It's no crime to burn more humus with higher yields. It *is* a crime if you don't put it back, full measure, into your soils.

Agronomists say that each rotation requires 8,000 to 12,000 pounds of organic matter per acre. If you do your part in this turnover of organic material, you can expect to maintain the tilth and fertility of your soil. Keep in mind, too, that organic matter holds *five times* as much moisture (pound for pound) as other soil material.

With the three NEW IDEA tools featured here you can do your part quickly and easily. The shredder pulverizes coarse surface material, which then decomposes rapidly into true humus — especially when worked immediately into your soil. A NEW IDEA-HORN loader speeds up manure handling — eliminates fatigue. The famous NEW IDEA Spreader is unsurpassed for fine shredding and controlled spreading.

You need these machines for humus-hungry crops and soils.

Award Winners Announced

The membership awards program, first announced in *News Notes and Activities* in September 1953, closed on July 1, 1954.

Recipients of the top awards for securing new members are Val K. Silkett of Iowa and George Jorgensen, Jr., of Kansas.

In addition to the two top winners —15 members qualified for gold tie clasps, 42 for bronze emblem buttons. Winners, their awards and number of members turned in during period of contest follow:

$50.00 Award

Val K. Silkett, Iowa	58
G. N. Jorgensen, Jr., Kans.	39

Gold Tie Clasp Winners

Wayne Kessler, Ariz.	25
Richard Kirch, Mich.	24
V. A. Surface, Ariz.	24
Ray W. Parker, N. Dak.	24
Harley Jaquot, Wash.	24
O. D. Hall, Ga.	22
Ernestine Mitchell, D. C.	17
A. B. Linford, N. Dak.	14
F. E. Bear, N. J.	12
E. D. Bolton, Tex.	12
H. S. Hokenstad, N. Dak.	12
H. C. Latvola, Minn.	12
Leonard Newman, W. Va.	12
H. D. Bradley, Ky.	11
O. M. McConkey, Ont.	11

Bronze Emblem Winners

R. M. Cormack, So. Rhodesia	10
Wm. H. Curry, W. Va.	10
Amos Turner, W. Va.	10
Gordon Hatch, Mich.	10
Geo. E. Reid, Fla.	10
Geo. O. Walker, Ill.	9
Ross Mellinger, W. Va.	9
F. D. Austin, W. Va.	9
N. G. Bobst, Nebr.	10
Glen Baker, W. Va.	9
C. C. Carleton, Tex.	9
I. O. Hembre, Wisc.	9
Stewart H. Jessee, Okla.	9
H. H. Highsmith, Wisc.	8
G. C. Herting, N. Y.	8
W. C. Gumbel, W. Va.	8
Benton E. Davis, Pa.	8
Mel Cohee, Wisc.	8
E. L. Worthington, N. Dak.	8
Paul Anderson, Md.	8
Malcolm E. Strom, S. Dak.	8
Elmer R. Umland, N. Dak.	8
O. V. Vande Linde, W. Va.	8
Glen Montgomery, W. Va.	8
L. A. Jacobsen, Fla.	8
Glen Longley, Wash.	7
Wesley Larsen, N. Dak.	6
Frank D. Martin, Minn.	6
Lloyd Mitchell, Nebr.	6
Allen H. King, Tex.	5
T. R. Littlefield, Calif.	5
H. H. Hopper, Calif.	5
C. H. Gleason, Calif.	5
Wellington Brink, D. C.	5

Honorable Mention:

Tom Pozarnsky, S. Dak.; J. Barksdale, Tex.; E. O. Hill, Wis.; John Smith, Md.; S. R. Swanson, N. C.; Elmer Taylor, Mich.

To be eligible for an award a member must have submitted applications for five full members or a combination of seven members and associates.

ANNUAL ELECTION

No report from nominating committee had been received as the JOURNAL went to press; however, ballots for the annual election, the proposed change in the Constitution and By-Laws, and the selection of the outstanding article, will be mailed to all members on September 15th.

POSITION OPEN

The city of Madison, Wisconsin, is accepting applications for Assistant Superintendent of the City Park Department. Salary range is $492.35 to $577.35 a month. A written and an oral examination will be given and applicants should write to Personnel Division, City Hall, Madison 3, Wisconsin for forms and additional information.

CHAPTER NEWS

Southern New England: A very successful meeting of the chapter was held at New Milford, Connecticut, on August 2nd with 135 in attendance. The group met in the Connecticut Light & Power Company office and used their auditorium to view the film "Valley of the Housatonic. Paul V. Hayden, vice-president; Harold Keeler, district manager; and Pat McBurnett, engineer, explained the plant of the power company and the operation of the dams. A chicken barbeque was held at noon.

Dr. Albert E. Burke, Director of Graduate Studies, Yale Conservation Program, discussed the study being made of the Housatonic Valley. F. J. Hopkins, Field Representative, Soil Conservation Service, outlined the current watershed legislation. Later in the afternoon a visit was made to observe conservation practices on the State Hospital Farm where Floyd Hileman was in charge. The members also visited the Shepaug Power Development.

Keystone: The chapter will hold its annual meeting at the Mont Alto Forestry School near Mont Alto, Pennsylvania, on August 27-28. Arrangements were made with the Forestry School to house chapter members.

Vernal C. Miles, Chairman of the Program Committee, announced that the program would be built around two subjects: "Working with People" and "Industry's Interest in Soil and Water Conservation." Walter C. Gumbel, Editor of the *Journal of Soil and Water Conservation*, was scheduled to appear on the program.

West Virginia: The three day annual meeting of the chapter is scheduled to be held at Jackson's Mill, State 4-H Camp, on September 24-25-26. Highlights of the meeting include a keynote talk by Walter C. Gumbel, Editor of the *Journal of Soil and Water Conservation*; a paper by Lloyd Harold, Project Supervisor of Agricultural Research at Coshocton, Ohio, will cover: "Wanted: Factual Data for Evaluating the Effect of Water Conservation Program on the Land."

A tour of the Salem Fork Watershed under direction of John Grant, Manager of the Upper Monongahela Valley Assoication, Inc., is scheduled for Saturday afternoon. Speaker at the annual banquet on Saturday evening will be D. A. Williams, Washington, D. C., Administrator, Soil Conservation Service and national council member, Soil Conservation Society of America.

Salina: Over 45 members and guests attended the chapter meeting at a luncheon in Salina, Kansas, on July 28th. Leslie Johnson, Salina, was elected chairman while Tom Dicken was elected vice-chairman. H. E. Bergschneider of Hays was elected secretary and Verne Bathurst, McPherson, was elected treasurer. Council members include: Milton Saffry, Dodge City; DeWitt Abbott, Salina, and Roy Davis, Emporia.

San Francisco Bay: The chapter held a meeting at the Bayview Hotel, in Aptos, on May 27th, followed by a field trip which lasted all day on May 28th and covered 12 farms where conservation practices were viewed. According to Clark H. Gleason, chairman, Dr. David Weeks presented the technical background for the field trip at the Friday evening dinner meeting.

Washington: The Chapter, under the direction of Chairman W. J. Endersbee, held their final meeting of the spring series at the Lantern House on May 19th. Discussion was held regarding "Latin American Conservation Picture" with panel leader, Annette L. Flugger and Dr. Alvaro Barcellos Fagundes, Brazil; Dr. Guillermo Nannetti, Columba; and Dr. A. B. Lewis, recently returned from Inter-America Institute of Agricultural Sciences, Costa Rica, discussing the subject.

It was announced the chapter would not hold meetings during June, July or August.

Pony Express: The chapter held their June meeting in Leavenworth County with approximately 70 in attendance. A picnic presented by the members from Leavenworth was well received. It was decided that the chapter would sponsor a booth at the Little Delaware-Mission Creek Watershed Field Day on August 18, 1954. The chapter will also issue a news letter to its membership in August.

Michigan: The Executive Committee of the chapter have held three meetings, committees are all working and plans are under way for the fall meeting to be held in the Grand Traverse area on October 9-10. Headquarters will be the Twin Lakes 4-H Club Camp.

The chapter has recently published a second newsletter for the year.

GET A NEW MEMBER TODAY

YOU ARE INVITED

Members and friends of the Soil Conservation Society are invited to attend the 9th annual meeting in Jacksonville, Florida, November 15-16-17th. An outline of the program is elsewhere in this issue together with hotel information. On September 15th an advance copy of the program will be mailed to all members.

Complete plans have not been announced but tours to Marineland, to St. Augustine, etc., are being arranged for the ladies. Many families are planning a vacation to precede or follow the annual meeting. Plenty of vacation opportunities exist near Jacksonville and in other parts of Florida.

Members may also take advantage of the opportunity to participate in the meeting of the Joint Committee on Grassland Farming which will be held on November 13th and 14th.

Plan your Florida trip now!

JACKSONVILLE

November 15-16-17

CHAPTER NEWS

Ontario: The chapter met on June 2nd at the Ontario Agricultural College, Guelph. The meeting was called to order in Massey Hall with an address of welcome by Dr. J. D. MacLachlan, President of O.A.C. Reports of the Research Committees of the Chapter took the remainder of the forenoon session. Dr. E. G. Pleva gave the report for the Education Committee followed by Prof. H. Ayers for the Irrigation Committee and Prof. P. A. Wright for the Economics Committee.

The afternoon session was a field trip to visit the Field Husbandry Plots of the College, and to the Hydrologic Station which was established in 1952 on a cooperative basis between the Soils and Agricultural Engineering Departments of the College. A visit was also made to the four watersheds, about 15 acres in size, under the supervision of the Department of AGRICULTURAL Engineering, where studies are being made on runoff, peak discharges, land use practices, etc.

The tour also stopped at the farm of Harry Smallfield who was the first local farmer to request a detailed plan for conservation farming. The plan, except for minor revisions, has been in operation for seven years. One of the watershed studies in on the farm. Another stop was made at the farm of Mr. and Mrs. Alfred Leatherbarrow, near Elora. In the past three years he has changed from a grain and grass plan to entirely grassland farming. Mrs. Leatherbarrow has written a book giving details of their experiences on the farm.

An elaborate two-color program with the Society's emblem on the front cover was distributed to members in attendance. The Ontario Chapter has approximately 90 members.

Iowa: The Northwest Iowa meeting of the chapter will be held in the form of a tour and Dutch Treat dniner on September 22nd. The tour will start at Mapleton, Iowa, at 1:00 P.M. and carry the group through the Little Sioux Watershed. At 5:30 P.M. dinner will be served at the Izaak Walton Club House at Browns Lake near Sioux City. Program for the evening will include a talk by H. Wayne Pritchard — "The Soil Conservation Society of America." Alden Erskine, President Iowa Division Izaak Walton League, will discuss "The Community Approach." George Eason, Chairman of Floyd Watershed Association and a discussion leader at the forthcoming National Watershed Congress, will discuss "Floyd Watershed Development."

The Southwest Iowa meeting of the chapter will be held on September 23rd with an afternoon tour of the Mule Creek Watershed near Malvern and an evening meal at 5:30 P.M. on the Glenwood State Farm at Glenwood. The evening program will feature a panel discussion on watersheds with T. J. Powell and Ray Jones as leaders.

Ozark Mountain: No business was transacted but members and families enjoyed fellowship, fried chicken, etc., at the spring meeting of the chapter on May 22nd when the group met at Lake Wedington. Forty-five were present for the affair. (Ed's Note—Wonder what "etc" included? —I know their fried chicken was good!)

Minnesota: Members of the Minnesota Chapter met at the Henry Snow farm near Kasson, Minn., on July 24th. This was the farm where the 1952 National Plowing Match and Soil Conservation Field Day was held —the farm where two presidential candidates spoke that year.

Due to the events that occurred on the farm in 1952, to statements made by political candidates the farm has been referred to as "the farm of a thousand promises." W. H. Kircher of the *Minnesota Farmer* speaking to chapter members at the July 2nd meeting stated, "Certainly the promises made by conservationists have been maintained for today Mr. Snow told us that he has the best prospects for corn, soybeans, and hay of any time since he has been on the farm." The practices on the Snow farm have been maintained with plans for more to be added. The farm is 160 acres. Two years ago 20 acres of virgin swamp or bog was drained which allowed Mr. Snow to improve his rotation and materially increase his production.

Following a tour of the farm the group met at the Dodge Center Community Park where it had been arranged for all to enjoy a picnic dinner. Dr. M. M. Hargraves of Rochester, Honorary Member of SCSA, installed Lee Moore, St. Peter, as new chairman; William W. Russell, St. Paul, Vice-chairman; Werner Schaenzer, St. Paul, secretary; P. J. Penn, Minneapolis, Executive Committee Member. Past chairman H. A. Flueck presided at the business meeting which was attended by H. Wayne Pritchard, Executive Secretary of the Society.

Red River Valley: The Red River Valley Chapter met at Douglas Lodge, Itasca State Park, Lake Itsaca, Minnesota, for their summer meeting.

Southern California Chapter: The chapter met at Riverside, California, on June 12th where a picnic was held on the Citrus Experiment Station grounds. Dr. L. A. Richards of the U. S. Salinity Laboratory spoke to the group on "Soil, Water, Salinity, and Plant Growth."

Ladies and children were treated to a mid-afternoon tour of the world famous Mission Inn while all enjoyed a tour of the new University of California campus at Riverside.

The previous meeting of the Southern California Chapter was held at Glendora and the San Dimas Experimental Forest on April 3, 1954. New officers of the chapter announced at the meeting included Charles W. Thomas, San Diego, chairman; Charles B. Ahlson, San Fernando, vice-chairman; George Borst, Jr., Fallbrook, treasurer; Maurice Donnelly, Riverside, secretary.

Wisconsin: Officers of the chapter have been holding regular meetings to assist in carrying out the program for the year. Membership cards have been printed using a design by Felix Summers who won the national emblem design in 1952. Committees have been active in contacting libraries of colleges and normal schools regarding the *Journal of Soil and Water Conservation*.

Chairman Hembre recently reported that progress was being made in securing a roadside marker commemorating the first soil conservation project at Coon Valley. He had contacted the Vernon and Monroe County Soil Conservation District supervisers, the Wisconsin Highway Department and the Wisconsin Historical Society.

Theme of the third in a series of summer meetings held at State College Campus, Platteville, Wisconsin, on September 10, was "Research in Resource Conservation." During the forenoon the members present toured the Mound Branch Watershed with James Meshnick and C. C. Bowers as leaders. After lunch in the college cafeteria the following program was held:

Welcome—C. O. Newlun, President, Wisconsin State College, Platteville.

"Research in Soil and Water Conservation"—Orville E. Hayes, Project Supervisor, Agricultural Research Service, Experiment Station, La-Crosse.

"Work of Forest Products Laboratory in Relation to Good Land Management"—B. Francis Kukachka, Forester, Forest Products Laboratory, Madison.

"Fisheries Research in Wisconsin"—Edwin Cooper, Chief of Fisheries Research, Wisconsin Conservation Department, Madison.

"Engineering in Conservation"—A. J. Wojta, Assistant Professor of Soils and Agricultural Engineering, University of Wisconsin, Madison.

"Forest Research of Wisconsin" — Joseph H. Stoeckeler, Forester, US DA Forest Service, Lake States Forest Experiment Station, Rhinelander.

"Wildlife Research in Wisconsin" — Cyril Kabat, Chief of Wildlife Research, Wisconsin Conservation Department, Madison.

Dinner at the College.

Dinner speaker—Dr. George Browning, Agricultural Experiment Station, Ames, Iowa—"Research Problems in Soil and Water Conservation."

"My Farm and My Community" — Carl Gobrecht, Belmont, Wisconsin.

"Research in Agronomy"—Professor D. C. Smith, Department of Agronomy, University of Wisconsin.

"Economics in Conservation" — Lee Day, Assistant Professor, Agricultural Ecoonmics, University of Wisconsin, Madison.

KENNETH K. NEITZEL,
Executive Secretary.

SUPPORT YOUR LOCAL CHAPTER